

Identification of Neotropical blow flies of the genus *Calliphora* Robineau-Desvoidy (Diptera: Calliphoridae) with the description of a new species

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Abstract

A key to the six known species of *Calliphora* Robineau-Desvoidy (Diptera: Calliphoridae) from the Neotropical Region is given. Species distributions and key characters are discussed. *Calliphora irazuana* Townsend, 1908 is resurrected as a valid name for a species found in Central America and Mexico, **stat. nov.** *Calliphora triseta* sp. nov. is described from numerous specimens from Costa Rica, El Salvador and Mexico. Nominal species *Calliphora nigra* Mello, 1974 and *Calliphora antojuanae* Mariluis, 1982 are synonymized with *Calliphora nigribasis* Macquart, 1851, **n. syn.** An Appendix is provided that clarifies the status of the names *Calliphora peruviana* Robineau-Desvoidy, 1830, *Lucilia peruviana* Robineau-Desvoidy, 1830, and *Calliphora peruviana* Macquart, 1851.

Key words: blow flies, *Calliphora*, Calliphoridae, Diptera, key, Neotropical, new species

Introduction

The first species of *Calliphora* described from the Neotropical Region was *Calliphora peruviana* Robineau-Desvoidy, 1830, but this is now considered a species of *Lucilia* Robineau-Desvoidy, 1830 (see Appendix). Macquart (1851) described *C. nigribasis* from Colombia, which was later treated by Hall (1948) as a synonym of *C. peruviana* (herein considered a misidentification, the valid name is *C. nigribasis*; see Appendix). Townsend (1908) described *C. irazuana* from Costa Rica. Shannon (1923) synonymized *C. irazuana* with what he called a “dark bearded form” of *C. vomitoria* (Linnaeus) (a Holarctic species misidentified from the Neotropical Region). Later, Shannon (1926) treated *C. irazuana* as a synonym of *C. nigribasis*. Hall (1948) questionably synonymized *C. irazuana* with *C. terraenovae* Macquart (a Nearctic species misidentified from the Neotropical Region) (*C. irazuana* is herein considered a valid species). Mello (1962) described *C. lopesi* from southern Brazil. Mariluis (1978) described a new species of *Calliphora*, *C. calcedoniae*, but later Mariluis and Peris (1985) synonymized it with *C. nigribasis*. More recently, *C. maestrica* was described based on four females from Cuba (Peris *et al.* 1998). Whitworth (2010) redescribed this species (including the male for the first time) and expanded its known range to include Jamaica and Dominican Republic.

Studies of the Neotropical species of *Calliphora* have been conducted in Brazil and Argentina where the genus is represented by only two described endemic and one introduced species. The South American *Calliphora* species *C. lopesi* Mello, *C. nigribasis* Macquart and the introduced *C. vicina* Robineau-Desvoidy have been studied by a variety of authors (Mello 1962; Mariluis 1978; Mariluis & Peris 1985; Baumgartner & Greenberg 1985; Peris & Gonzales-Mora 1989). No studies have been conducted on the Central American *Calliphora*, though they were recently discussed by Vargas & Wood (2010). Those authors suggested that the single Central American *Calliphora* species may be *C. irazuana*, which I can confirm is the case after having examined Townsend’s type of the species. In addition, this study revealed a previously unknown species of *Calliphora* that is described herein.

This study of Neotropical *Calliphora* was initiated to address the following issues: to establish what valid species occur in the region; to provide a key to permit identification of the species; to redescribe the known species of *Calliphora*; to resurrect a previously described species (*C. irazuana*); and to describe a new species (*C. triseta*).

Material and methods

Geography. The Neotropical Region is defined as including South America, Central America, the West Indies, and portions of southern Mexico along the east and west coasts. See Brown *et al.* (2009, fig. 1.1) for a map showing the boundary between the Nearctic and Neotropical Regions. Location coordinates given for many INBIO specimens use the Lambert Norte system and are expressed as L_N_.

Terminology. The terminology primarily follows McAlpine (1981), but see exceptions discussed in Whitworth (2006). See Whitworth (2006, 2010), Rognes (1991) and Hall (1948) for further discussion of key characters and illustrations. Some proportional measures are included, see Whitworth (2006, figs. 23, 24) for measurement of the frons to head ratio. The expression “frons 0.10 (0.08–0.11/5) of head width at narrowest” means frons averages one-tenth of head width measured at narrowest point in five specimens. Similar proportions are used for frons/first flagellomere, parafacial/frons, parafacial/first flagellomere and gena to eye ratios. Measurements were made with an ocular micrometer.

Abbreviations. For abdominal sclerites, tergites are identified as T and sternites as ST. T1+2 is the first apparent abdominal segment, followed by T3–5 in males and T3–8 in females; sternites are ST1–5 in males and ST1–8 in females.

The acronyms of collections cited in this work are as follows:

BG	Bernard Greenberg Collection, currently in part in TW Collection, ultimately to be permanently deposited in other institutions.
BMNH	Natural History Museum [formerly British Museum (Natural History)], London, United Kingdom.
BYU	Brigham Young University, Provo, Utah, USA.
CMNH	Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA.
CNC	Canadian National Collection of Insects, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada.
FIOC	Fundacao Instituto Oswaldo Cruz, Rio de Janeiro, Brazil.
FSCA	Florida State Collection of Arthropods, Gainesville, Florida, USA.
INBIO	Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica.
IZAC	Academia de Ciencias de Cuba, Instituto de Zoologia, Habana, Cuba.
LACM	Los Angeles County Museum of Natural History, Los Angeles, California, USA.
MNHN	Museum National d'Histoire Naturelle, Paris, France.
OUMNH	Oxford University Museum of Natural History, Hope Entomological Collections, Oxford, United Kingdom.
TAMU	Texas A&M University, College Station, Texas, USA.
TW	Terry Whitworth Collection, Puyallup, Washington, USA.
UCDC	University of California, R.M. Bohart Museum of Entomology, Davis, California, USA.
USNM	National Museum of Natural History [formerly United States National Museum], Smithsonian Institution, Washington, District of Columbia, USA.
USU	Utah State University, Logan, Utah, USA.
WSUP	M.T. James Entomological Collection, Washington State University, Pullman, Washington, USA.

Illustrations. Features unique to species of Neotropical *Calliphora* are illustrated herein or the reader is referred to illustrations elsewhere. See Hall (1948), Rognes (1991) and Whitworth (2006, 2010) for other calliphorid characters.

Dissections. Genitalic dissections were performed by gently prying the abdomen up and down to break it away from the thorax. The abdomen was placed in a hot solution of 10% potassium hydroxide in a test tube and suspended in a bath of boiling water for about two to four minutes to soften and partially clear it. It was next rinsed in

a bath of distilled water for a few minutes, then rinsed in 95% ethyl alcohol and finally placed in glycerin to dissect the genitalia. When transferring between solutions, the excess fluids were absorbed by touching the parts against a paper towel. In males, sternites ST1–ST5 were cut out with micro scissors and laid back, then the genitalia capsule and sternites were removed. The sternites were separated from the genitalia at ST5 and retained for further study; sternites in females have not yet been used. The remaining abdomen was dehydrated for a few minutes in 95% ethyl alcohol, soaked in xylene for a few more minutes, then air dried and glued to a card under the specimen or reattached to the specimen's thorax with glue. If necessary, the genitalic capsule and sternites were again placed in potassium hydroxide in a water bath to further clear and macerate soft tissue to complete genitalic dissection. This was followed by a water bath, treatment in acetic acid to neutralize the potassium hydroxide and finally dehydrating in 95% ethyl alcohol before transferring to glycerol. Ovipositors and spermathecae were generally mounted on slides; specimens in glycerol were rinsed in 95% ethyl alcohol, blotted on a tissue and transferred to a drop of Euparal which was covered with a slide cover. Slides were dried for about two weeks in a warming oven at about 65°C to harden the Euparal.

Dissection tools included fine point tweezers, 2 and 4mm micro scissors, and various fine probes utilizing tungsten needles and insect pins purchased from BioQuip Products, Rancho Dominguez, CA, and World Precision Instruments, Sarasota, FL. Dissections were performed primarily with a Bausch and Lomb Stereozoom 7 microscope equipped with 10–20x oculars allowing magnification to 140x. Most photography was done with a Nikon D90 camera through a Meiji Techno stereomicroscope with a focus range of 7.5–112.5x using 1.0x or 1.5x objectives. To improve depth of field, a series of 5–20 images were taken through the microscope, then Helicon software (heliconsoft.com) was used to merge the photos. Slides of small specimens were studied with the aid of a CHT model Olympus compound microscope with 40–400x lenses. Lighting was supplied by dual fiberoptic lights, and a light ring and dome were used for many photos. See Kerr *et. al.* (2008) for more information about using a reflective dome for photography. Additional information on this subject can be found under dome lighting on the California Department of Food and Agriculture website (<http://www.cdfa.ca.gov/phpps/ppd/entomology/Dome/kd-200.html>).

Collection areas and collection techniques. Most of the material used for this study was borrowed from the institutions cited above. Additional specimens were collected by the author during visits to the area around Cardona, state of Soriano, Uruguay and various areas around San Jose, Costa Rica in San Jose and Heredia Provinces. Flies were collected with bait traps baited with fish or chicken flesh and entrails. See Whitworth (2010) for details about traps and trapping techniques. Since that publication, a very light weight, portable and economical “Pop-up Butterfly Bait Trap” has become available from BugDorm Store (<http://bugdorm.megaview.com.tw/pop-up-butterfly-bait-trap-cone-type-pack-of-6-p-143.html>). This trap has been tested and found to be as effective as previously used traps that were bulkier and more expensive.

Specimen counts by sex, collection dates and locations are given for all specimens examined. Most labels are in Spanish or Portuguese and were sometimes difficult to interpret. In most cases data was recorded exactly as written on labels, except for obvious spelling errors.

Subfamily Calliphorinae

Genus *Calliphora* Robineau-Desvoidy, 1830

Calliphora Robineau-Desvoidy, 1830: 433. Type species: *Musca vomitoria* Linnaeus, 1758 by original designation, one of a total of 17 species, including *peruviana* RD.

Dear (1985) has provided a key to the Neotropical subfamilies of Calliphoridae. The subfamily Calliphorinae is represented in the Neotropical Region by a single genus, *Calliphora*. The genus can be distinguished from other Neotropical calliphorid genera by its bare stem vein, lower calypter setose above, bare suprasquamal ridge, thorax dull grey with whitish microtomentum, and abdomen subshining metallic blue with more or less whitish microtomentum.

Other characters in common for species of the genus include a robust orange palpus with stout black setae; parafacial black to brown, lower half sometimes reddish to orange; parafacial with one or two changeable spots in both sexes, females also with a changeable spot midway on fronto-orbital plate when viewed from above; gena

usually brown or black, anterior half may be more or less orange in *C. irazuana*, while it is usually bright orange in *C. vicina*; genal groove black in *C. nigribasis* and *C. triseta*, usually reddish in the other four species; pedicel and first flagellomere size variable, brown to reddish-brown; single row of strong postocular setae present, usually some additional irregular rows below; occiput with silky gold or silvery setae. Thorax with typical chaetotaxy; normally two postsutural intra-alars, but three postsutural intra-alars in *C. triseta*; sometimes a tiny seta in front of the two usual setae in *C. irazuana*; setation of humeral callus normally 3+1, in *C. maestrica* 2+1; lateral scutellar setae 4+4 except in *C. maestrica* 3+3; katepisternal setal formula normally 2+1, in *C. maestrica* 1+1; proepisternal depression dark silvery with brown to black setae; anterior spiracle brown to orange-brown, posterior spiracle usually darker brown. Base of wing infuscated along costa to apex of costal cell, angling back to anterior edge of basal medial and posterior cubital cells, intensity and extent of area with color somewhat variable (Fig. 7), except hyaline in *C. vicina*; upper calypter, rim and fringe more or less dark brown; rim and fringe of lower calypter normally brown to reddish brown in two species, *C. irazuana* and *C. nigribasis* (Fig. 4), rim and fringe are usually white or pale in the remaining four species, including *C. lopesi*, *C. maestrica*, *C. triseta*, and *C. vicina* (Fig. 3); bend in vein M closer to wing margin than to dm-cu crossvein (as in Whitworth 2006, fig. 42) except equidistant in *C. maestrica*; basicosta and tegula dark brown to black, except basicosta yellow to orange and tegula black in *C. maestrica* and *C. vicina*.

Male. Frons narrow, 0.03–0.12 of head width (except for a frons/head ratio of 0.29 in male *C. maestrica*), without laterocinate and proclinate orbital setae, except for *C. maestrica* where these setae are present. In lateral view, *C. irazuana* and *C. lopesi* with long slender surstyli curving forward, in the former the surstylus ends in a sharp point while in the latter it ends bluntly (Figs. 8–11); surstylus in *C. nigribasis* similar, but shorter and more robust (Figs. 12, 13); *C. triseta* (Figs. 14, 15) and *C. vicina* (cf. Rognes 1991, figs. 140, 141) have broader, digitate surstyli which are parallel-sided; in *C. maestrica* surstyli are triangular (Whitworth 2010, fig. 11); from the rear, five species with surstyli curved more or less inward; in *C. maestrica*, surstyli forceps-like in posterior view with cerci embedded in the base of surstyli (Whitworth 2010, fig. 10). The phalli of all 6 Neotropical *Calliphora* are similar (Figs. 16–23). For *C. maestrica* see Whitworth (2010 figs. 12, 13) and for *C. vicina* see Rognes (1991, figs. 143, 144). The epiphallus is broad and cupped, angling more or less forward, the tip angling more or less sharply downward; it originates at the posterior end of the basiphallus in two species (*C. irazuana*, *C. lopesi*), midway in three species (*C. nigribasis*, *C. triseta*, *C. vicina*) and near anterior end in one species (*C. maestrica*); venter of hypophallus serrated posteriorly; tip of paraphallus foot-like and serrated apically in all but *C. maestrica*; this species has a hook-like tip of paraphallus with no apparent serrations; acrophallus similar in all species, venter of anterior end with posterior pointing denticles, more or less broad in dorsal view; all species appear to have lateral ducts. The hypandria of the four native *Calliphora* species in South and Central America are all similar (Figs. 24, 27, 30, 33). The distal end varies from broad in *C. nigribasis* to narrower in *C. irazuana*; in the West Indies species, *C. maestrica* hypandria are much more slender (Whitworth 2010, fig. 14). The hypandrium of *C. vicina* was not examined. The pre- and postgonites of all six *Calliphora* species are also similar. *Calliphora irazuana*, *C. lopesi* (Figs. 25, 28), and *C. vicina* (Rognes 1991, fig. 146) each normally have 4 setae on the pregonite, while in *C. nigribasis* and *C. triseta* (Figs. 31, 34) each has six setae and *C. maestrica* has about ten setae (Whitworth 2010, fig. 15). The postgonites of all species are similar; each has a single very fine seta at its inner base. This seta commonly breaks off during dissection but the socket is visible in some of the photos. The ejaculatory sclerites are similar in each species (Figs. 26, 29, 32, 35) (for *C. vicina* see Rognes 1991, fig. 145; for *C. maestrica* see Whitworth 2010, fig. 16). Sternites of *C. irazuana*, *C. lopesi*, *C. triseta* (Figs. 36, 37, 39) and *C. vicina* are typical of most other New World species of this genus while in two species, *C. nigribasis* (Fig. 38) and *C. maestrica* (Whitworth 2010, fig. 17) ST5 is exceptionally broad.

Female. Frons broad with one laterocinate seta and two proclinate setae. Ovipositors and spermathecae of five species are similar (Figs. 40–47), for *C. vicina* see Rognes 1991 (figs. 147, 148). *Calliphora maestrica* ovipositor (Whitworth 2010, fig. 18) is much different; anterior portion of T6 in *C. irazuana* and *C. lopesi* broader, tapering to a narrower posterior; T6 more oval in *C. irazuana*, *C. nigribasis*, and *C. triseta*; very broad, but short in *C. maestrica*; T6 with central area weak in *C. irazuana*, *C. lopesi*, *C. nigribasis* and *C. maestrica*, only anterior edge weak in *C. triseta* and no weak areas in *C. vicina*; anterolateral corners of T6 weak in all species except *C. maestrica*. ST6 is more or less oval in *C. irazuana*, *C. lopesi*, and *C. triseta*; while broader in *C. nigribasis* and narrower in *C. vicina* (Rognes 1991, fig. 148); in *C. maestrica* ST6 is broader than long (Whitworth 2010, fig. 18). T7 is almost divided in five species, with only a narrow connection on rear edge; in *C. maestrica* sclerites are com-

pletely divided. ST7 is long and parallel-sided in *C. irazuana*, *C. lopesi*, and *C. nigribasis*; while it tapers distally to a narrow neck and expands at the margin in *C. triseta* and *C. vicina*; in *C. maestrica* ST7 is large and oval with the lower portion isolated by a large horizontal weak area (Whitworth 2010, fig. 18). In all species, T8 is divided into two sclerites by a large membranous area; in five species ST8 is slightly longer than T8 with similar shape; posterior margin of *C. irazuana* and *C. lopesi* with a bifurcation lacking in others; in *C. maestrica* ST8 is reduced to two small triangular sclerites at the posterior margin. The epiproct, hypoproct and spermathecae are similar in all species (Figs. 40–47).

Discussion. Twelve specimens of *Calliphora coloradensis* Hough (FSCA) were examined from southern Mexico near the boundary of the Neotropical Region, State of Puebla near Tehuacan. In addition, seven *C. latifrons* Hough (FSCA) were found in the same area, as well as in several other locations in the highlands and further north in Mexico. A single *C. grahami* Aldrich(CNC) was examined collected from the mountains north of Mexico City, however it was not found further south in Mexico or in any of the Neotropical Region. None of these species is included in the key that follows; specimens suspected to be these species may be keyed using Whitworth (2006).

Key to the species of Neotropical *Calliphora*

1. Basicosta yellow to orange 2
- Basicosta brown to black 3
2. Genal dilation with black vestiture; katepisternal formula 1+1 (Whitworth, 2010, fig. 9); base of wing dark, infuscated along costa to apex of costal cell, angling back to anterior edge of basal medial and posterior cubital cells (as in Fig. 7); male frons broad, averaging 0.29 (0.028–0.30/5) of head width; male and female genitalia unique (Whitworth 2010, figs. 10, 11, 18), see detailed discussion and illustrations in Whitworth (2010); known only from West Indies in Cuba, Dominican Republic, and Jamaica *C. maestrica*
- Genal dilation with reddish vestiture on front half or more; katepisternal formula 2+1 (Whitworth, 2010, fig. 8); base of wing hyaline; male frons much narrower, averaging 0.075 (0.07–0.08)/4 of head width; characters illustrated in Rognes (1991, figs. 132, 139–148) and Mello (1962, figs. 1–10); known in the Neotropical Region from Argentina, Chile, Cuba, Falklands, Mexico, Panama, Uruguay *C. vicina*
3. Three postsutural intra-alar setae; lower calypter, rim and setal fringe whitish, especially near distal end (Fig. 3) (also in *C. lopesi*); parafacial uniformly dark brown or black; male frons narrow, less than half the width of the parafacial at widest, 0.031 (0.030–0.031)/5 head width; surstylus broad in lateral view (Fig. 14), from rear, cerci often distinctly y-shaped (Fig. 15, y-shape not distinct in photo); female, width of parafacial about equal to width of first flagellomere, 1.3 (1.1–1.5/5); known only from Costa Rica, El Salvador and Mexico (Fig. 1) *C. triseta*
- Two postsutural intra-alar setae; if three, then the first very tiny (sometimes in *C. irazuana*); lower calypter rim and fringe brown to reddish brown (except white in *C. lopesi*); lower half of parafacial orange color; male frons width variable; surstylus narrower in lateral view, from rear, parallel or V-shaped; female, parafacial 1.5–2x width of first flagellomere (except in *C. irazuana*); ranges do not overlap except in *C. irazuana* 4
4. Rim of lower calypter pale with whitish setae; genal groove red (also often red in *C. irazuana*, but ranges do not overlap); supravibrissal setae on facial ridge weaker, ascending from the vibrissa about halfway to antennal base (Fig. 5); male frons broad, about 1.6x width of parafacial, 0.066 (0.06–0.07/5) of head width; male surstylus slender in lateral view, cerci shorter than surstyli (Figs. 10, 11); female, T5 with no incision; known only from Brazil and Uruguay (Fig. 2) *C. lopesi*
- Rim and fringe of lower calypter usually darker, reddish, brown or black (as in Fig. 4); genal groove usually dark brown to black; setae on facial ridge stronger, usually ascending up from the vibrissa two-thirds or more toward antennal base (Fig. 6); other characters variable 5
5. Known only from Central America; genal groove usually reddish like lower parafacial; anterior half of gena often reddish-brown; setae on occiput yellowish; sometimes a third tiny postsutural intra-alar seta (usually much smaller than in *C. triseta*); male frons much narrower than width of first flagellomere, 0.034 (0.03–0.04/5) of head width; width of parafacial about equal to width of first flagellomere; surstylus slender in lateral view; cerci narrow in posterior view, about as long as surstylus (Figs. 8, 9); female parafacial 1.4x or less width of first flagellomere; known from higher elevations in Costa Rica, El Salvador, Guatemala and Mexico (Fig. 1) and is likely present in other Central American countries *C. irazuana*
- Known only from South America; genal groove usually dark brown to black, concolorous with gena color; gena all black to dark brown; white silky setae on occiput, extending into rear of postgena area; only two postsutural intra-alar setae; male frons wider than first flagellomere, 0.102 (0.09–0.12/5) of head width; width of parafacial about 1.9x width of first flagellomere; surstylus broader in lateral view; cerci broad in posterior view, shorter than surstylus (see Figs. 12, 13); female parafacial broad, about twice the width of first flagellomere, 2.3 (2.1–2.5/5); at high elevations in Argentina, Bolivia, Colombia, Ecuador, Peru, Venezuela (Fig. 2) *C. nigribasis*

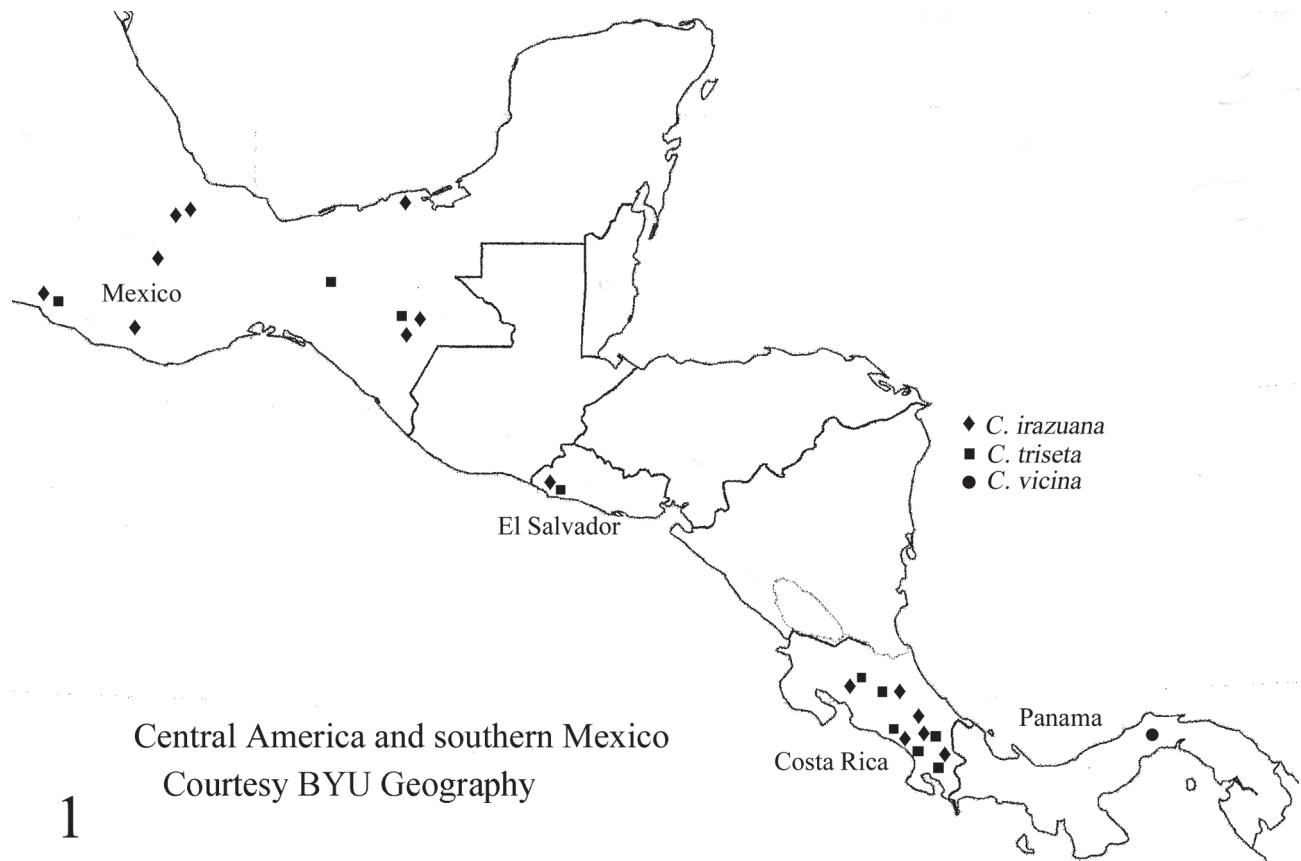


FIGURE 1. Map of Central America and southern Mexico showing the localities of examined specimens of *Calliphora irazuana*, *C. triseta* and *C. vicina*. Map does not show localities in northern Mexico.

***Calliphora irazuana* Townsend, 1908**

Figs. 1, 4, 8, 9, 16, 17, 24–26, 36, 40, 44, 51

Calliphora irazuana Townsend, 1908: 118; Vargas and Wood, 2010: 1303.

Calliphora vomitoria: Shannon, 1923: 115 (misidentification).

Calliphora nigribasis: Shannon, 1926: 134 (misidentification).

Calliphora terraenovae: Hall, 1948: 303 (misidentification).

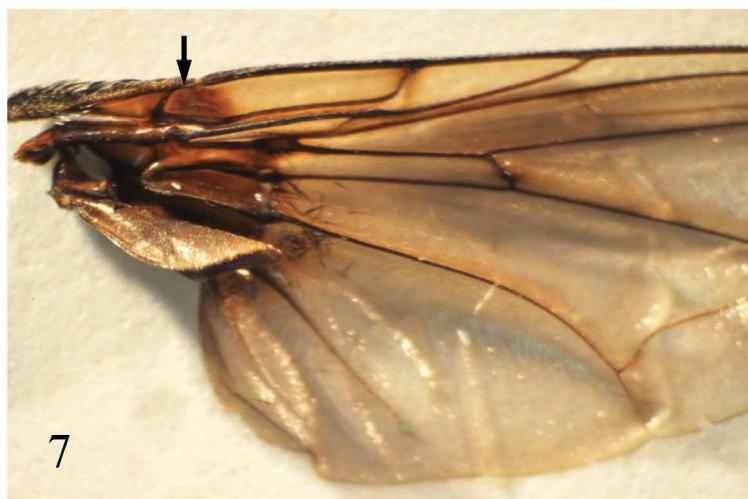
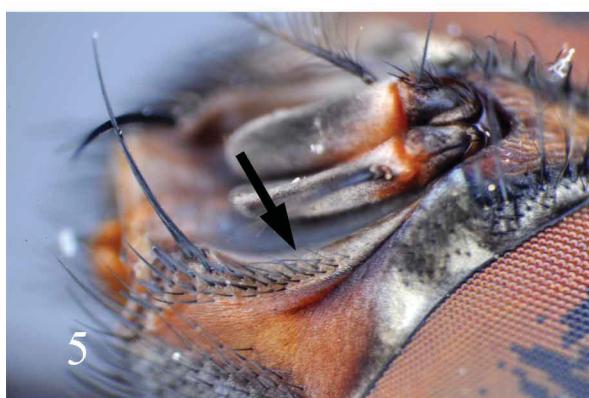
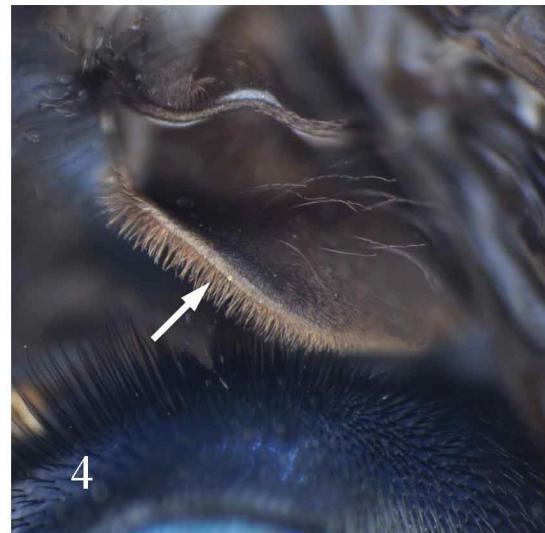
Type information. Townsend (1908) described *Calliphora irazuana* from a single female specimen (USNM, Type No. 10886). The holotype was collected by Schild and Burgdorf from Irazu, Costa Rica; no date of collection was given. The holotype was examined and specimen labels are shown in Fig. 51.

The holotype is typical of the female of this species described below. It is generally in good condition, though it is missing a tarsus on right side of midleg, venter of midthorax near pin has heavy white glue, and there are breaks in cuticle of dorsolateral area at base of abdomen on right side and at rear tip of scutellum. Only two postsutural intra-alar setae present, the type lacks the tiny extra postsutural intra-alar seta found in some specimens.

Diagnosis. Known only from higher elevations (900m or more) in Central America and Mexico. To distinguish *C. irazuana* from *C. triseta* (geographical ranges overlap): *C. irazuana* normally has only two postsutural intra-alar setae (some specimens have a tiny third seta barely larger than surrounding small setae) while *triseta* normally has a distinct third intra-alar seta. Additional character states of *irazuana* include genal groove usually orange versus brown or black; setae on back of head pale yellow versus whitish; lower calypter rim and setal fringe usually reddish brown versus pale whitish; anterior third to half of gena often with faint reddish coloration versus all dark; surstyli in lateral view short and slender versus broad and longer; male frons narrow, 0.034 (0.03–0.04/5) of head width, similar to *C. triseta*.



FIGURE 2. Map of South America showing the localities of examined specimens of *Calliphora lopesi*, *C. nigribasis* and *C. vicina*.



FIGURES 3–7. *Calliphora* character states. 3. *C. triseta*, pale whitish setae on upper surface, rim and fringe of lower calypter. 4. *C. irazuana*, brown setae on upper surface, rim and fringe of lower calypter. 5. *C. lopesi* male, setae extend about halfway up facial ridge. 6. *C. triseta* male, setae extend about 80% up facial ridge. 7. *C. nigribasis*, base of wing infuscated.

Description. Frontal vitta and lower parafacial reddish brown; anterior half of gena often more reddish brown in contrast to the rear half and postgena which is brown to dark brown; genal groove reddish brown to brown; upper parafacial and fronto-orbital plate faintly golden color when viewed from above, black to dark brown from below; occiput with 2–3 rows of stout black setae below the postocular row; center of occiput with silky yellow setae. Supravibrissal setae on facial ridge ascending about 70% up facial ridge toward antennal base (as in Fig. 6). Anterior thoracic spiracle brown to orange brown, lighter around opening, posterior spiracle dark brown; normally

with only two postsutural intra-alar setae, sometimes a third weak seta. Central area of upper calypter brown, outer margin pale, rim of calypter and fringe dark brown to black; lower calypter, including rim, usually dark brown with long reddish brown fringe. Males smaller, averaging 9–10mm in length, females larger, averaging 10–13mm.

Male. Frons narrow, at narrowest, 0.034 (0.03–0.04/5) of head width; 0.45 (0.39–0.50/5) of first flagellomere; parafacial wide, at narrowest, 2.4x frons width (1.8–2.8/5); about equal to first flagellomere 1.1 (0.92–1.2/5); gena to eye ratio 0.44 (0.42–0.46/5). Fronto-orbital plates meet in middle; frontal setae ascend about 2/3 up frons toward median ocellus. A contrasting changeable spot visible at top of parafacial. Surstyli and cerci in lateral view long and slender, similar to those in *C. lopesi* which is known only from southern South America; surstylus ending in sharp point versus rounded point in *C. lopesi*. In posterior view, cercus and surstylus equal in length (Fig. 9) versus cercus longer than surstylus in *C. lopesi* (Fig. 11). Phallus, hypandrium, pre- and postgonites, ejaculatory sclerites, and sternites as in Figs. 16, 17, 24–26, 36, respectively.

Female. Frons 0.35 (0.34–0.35/5) of head width at narrowest; 3.9 (3.4–4.4/5) of first flagellomere; parafacial, at narrowest, 0.36 (0.31–0.39/5) of frons; 1.4 (1.2–1.4/5) of first flagellomere; gena to eye ratio 0.58 (0.57–0.60/5). Frontal setae long and densely set, ascending to level of rear ocelli; one laterooclinate and two proclinate fronto-orbital setae present. Two changeable spots visible, one midway on fronto-orbital plate and one on upper parafacial. T5 with short incision, which can be difficult to see when tip of abdomen is curled under. Ovipositor and spermathecae as in Figs. 40, 44, posterior margin of ST8 bifurcated in this species and *C. lopesi*.

Specimens examined. 34 males, 122 females. **Costa Rica** (19 males, 112 females): **Alajuela Province:** 6 females, Rio Poasito, May 10, 1995, Baumann and Houseman (BYU). **Cartago Province:** 2 females, Cartago, 9°40'N 83°50'W, May 18–20, 1973, 2610m, J. Helava (CNC); 1 female, Villa Mills, May 2, 1980, T. Laverty, (CNC); 1 male, 5 females, Hgw. 2 km, 93, 9°36'N 83°45'W, April 7, 1985, H. Goulet, L. Masner (CNC); 1 male, 1 female, P.N. Tapanti-Macizo de la Muerte, el Tajo, 2840m, L_S_329700_593100, Feb. 11, 2002, M. Alfaro (INBIO); 1 male, Rio Macho, Camino a Torre 46, 2760m, L_S_396700_482550, 12 April, 1997, B. Gamboa (INBIO); 1 female, 4 km E Tres Rios, EAO, Nov. 11, 1988, F.D. Parker, J.B. Welch, F.R. Ramirez (USNM). **Heredia Province:** 1 female, Volcan Poas, Feb. 21, 1980, T. Laverty (CNC); 4 males, 38 females, Barva Volcano, 10°70'10"N 84°87'50"W Jan. 15, 2011, T.L. Whitworth (TW); 5 females, Barva, Braulio Carrillo P.N., 2500m, L_S_233400_523200, Dec., 1989, A. Fernandez (INBIO); 4 females, Vol. Poas, July 12, 1962, M.T. James (WSUP); 1 female, Barva Volcano, 2600m, L_S_235200_524600, Jan. 15, 1997, M.A. Zumbado, F.C. Thompson (INBIO); 1 female, P.N. Braulio Carrillo, transecto altitudinal Barva, La Selva, 2000m, L_S_240000_523800, Feb. 13, 2002, M.A. Zumbado (INBIO). **Limon Province:** 1 male, P. Int. La Amistad, Cerro Hoffman, 2460m, L_S_340258_577465, March 21, 2003, D. Rubi (INBIO); 1 male, same data, different collector, M. Alfaro; 1 male, P. Int. La Amistad, P.N. Chirripo, Llano Bonito km 7, 900m, L_S_378500_593100, March 31, 2007, M. Sobs (INBIO); 1 female, P. Int. La Amistad, 2450m, L_S_340258_577465, M. Alfaro, R. Delgado (INBIO); 1 female, Cerros Tararia, 2659m, L_S_344600_576700, April 23, 1997, R. Villalobos (INBIO). **Puntarenas Province:** 1 male, P. Int. La Amistad, Buenos Aires, Estacion Altamira, Cerro Quemado, 2279m, L_S_336200_575560, Jan. 9, 2002, M. Alfaro (INBIO); 2 males, same as above except Cerro Cabecar, 2900m, L_S_366400_530800, 23 March, 2007, M. Sobs (INBIO); 1 male, Estacion. La Casona, Monteverde, 1520m, L_S_253250_449700, 1520m, April, 1992, K. Flores (INBIO); 1 male, Sendero a Cerro Echandi, 2600m, L_S_329700_593100, April 13, 1998, B. Gamboa (INBIO). **San Jose Province:** 1 male, Corralar Arriba, Sta. Ana, 1700m, L_S_207000_516000, April 9, 1994, M.A. Zumbado, F.G. Zumbado, H. Vargas (INBIO); 1 male, 5 km E. de Villa Mills, 2700m, L_S_390100_500100, 2700m, April 1, 1996, B. Gamboa (INBIO); 1 male, Escazu, Oct. 22, 1989, F.D. Parker (USU); 2 females, Cerro de la Muerte Hwy, Aug. 14, 1966, 9500ft, D.F. Veirs (USU); 1 female, Cerro de la Muerte, Rio Savegre at San Gerardo de Dota, 9°33'N 83°4-8'W, 2200m, Aug. 8-10, 1995, C.R. Nelson #6248, Malaise trap (BYU); 1 female, 1 mi NW Villa Mills (La Georgina) 9°34'N 83°41W, March 23, 1967 (USU); 1 female, Cerro de la Muerte, cloud forest above Rio Savegre at San Gerardo de Dota, 9°33'N 83°48'W, 2600m, Aug. 9, 1995, C.R. Nelson (BYU); 2 females, Cerro de la Muerte, Aug. 25, 1970, R.W. Merritt (USU); 2 females, Cerro de la Muerte, 6 km W Villa Mills, Inter-Am Hwy, 3340m, E.R. Heithaus, Oct. 29, 1971 (WSU); 1 male, 35 females, Tres de Junio, 2675m, 9°39'8"N 83°51'3W, Jan. 16, 2011, T.L. Whitworth. **El Salvador:** (2 males, 2 females) 2 males, 1 female, Santa Ana, Youcan, Sept. 26, 1956, P.A. Berry (USNM); 1 female, same as above except March 5, 1957. **Guatemala** (3 males): 1 male, Huehuetenango, 15 km nw Todos Santos Cuch., Aug. 31, 1987, 2500m, M. Wood; 2 males, same data except 10 km nw Todos Santos (CNC). **Mexico:** (10 males, 8 females) 1 male, La Venta, Aug. 9, 1969, D. Kritsch (CNC); 4 males, 3 females, 10 mi W. El Salto, Dgo, 9000ft, June 2, 1964, J.F. McAlpine (CNC);

1 male, Chis., 5 mi W San Cristobal, March 3, 1969, 7500ft, H.J. Teskey (CNC); 1 female, W slope Popocatepetl, 9600ft, July 15, 1951, P.D. Hurd (WSU); 1 female, State of Chiapas, 16 mi W San Cristobal de la Casas, July 16, 1967, P.D. Hurd (TW); 1 female, State of Mexico, Mt. Tlaloc, Chapingo, Aug. 13, 1974, Mac Tidwell (FSCA); 1 male, State of Chiapas, 42 mi W Cintalpa, March 4, 1985, L. Strange, R. Miller (FSCA); 1 male, 1 female, State of Mexico, 36 mi SE Mexico City, Puebla Turnpike, 9000ft, April, 26, 1965, H.V. Weems (FSCA); 2 males, 1 female, State of Guerrero, Omilteme, 8000ft, July, year unknown, H.H. Smith (BMNH).

Distribution. Costa Rica, El Salvador, Guatemala, Mexico, higher elevations, 900–3000m (Fig. 1). This species is common in the mountains around San Jose, Costa Rica and likely occurs in mountainous regions throughout Central America. In Costa Rica it was found in the Cordillera de Talamanca which extends into Panama, the Coastal Ridge, Cordillera Central and Cordillera de Tilaran. It was not found in the Guanacaste area in the northwest, but this may reflect lack of collection effort, or lack of suitable habitat.

Discussion. It was difficult to find characters common to both sexes that consistently separate *C. irazuana* from *C. nigribasis*. The male genitalia of *C. irazuana* and *C. nigribasis* are very different and will reliably separate males, while some females can be more difficult to distinguish. Another difference in the male is the frons is narrow in *C. irazuana* (0.03 of head width) and much wider in *C. nigribasis* (0.10 of head width). The genal groove and anterior half of gena are reddish in many *C. irazuana*, while this area is usually brown or black in *C. nigribasis*; however, the color can be variable. The occiput has yellowish setae in *C. irazuana*, while the setae are whitish in *C. nigribasis*. Range alone will separate these two species, except possibly where they could overlap in southern Central America or northern South America. About a third of the specimens of *C. irazuana* examined have a weak third postsutural intra-alar seta, a condition similar to that sometimes found in the Nearctic *C. latifrons* Hough. This condition could cause confusion with *C. triseta*, however other characters are sufficient to distinguish this species where it occurs.

***Calliphora lopesi* Mello, 1962**

Figs. 2, 5, 10, 11, 18, 19, 27–29, 37, 41, 45

Calliphora lopesi Mello, 1962: 270; James, 1970: 12; Peris and Gonzalez-Mora, 1989: 184; Mello, 2003: 262.

Type information. Holotype male and allotype female (FIOC). Type locality: Brazil, Rio de Janeiro, Teresopolis. Not examined.

Diagnosis. Known only from Brazil and Uruguay. Separable from *C. nigribasis* based on the reddish genal groove (black in *C. nigribasis*); on the white rim and fringe of setae on the lower calypter (as in Fig. 3) (dark reddish brown in *C. nigribasis*, as in Fig. 4); male frons narrower, averaging 0.066 (0.06–0.07/5) (whereas averaging 0.102 (0.09–0.12/5) in *C. nigribasis*); male surstyli and cercus slender (Figs. 10, 11) (whereas shorter and more stout (Figs 12, 13) in *C. nigribasis*); ST5 normal (Fig. 37) (exceptionally broad (Fig. 38) in *C. nigribasis*); female T5 without incision (T5 with incision in *C. nigribasis*).

Description. Lower parafacial and genal groove reddish; upper parafacial and fronto-orbital plate with pale brown microtomentum as seen from above; parafacial darker as seen from below, with two changeable spots, the lower one faint; fronto-orbital plate black with one changeable spot on lower half in female; frontal vitta with upper portion black and lower portion reddish; pedicel brown to black, base of first flagellomere reddish, the color extending toward distal end on posterolateral sides, the remainder brown; genal dilation dark brown to black with silvery microtomentum; occiput with several rows of long dark occipital setae below postocular row, central occiput with silvery setae, less extensive than in *C. nigribasis*; ocellar triangle small, anterior ocellus about 2x the diameter of the posterior ocelli; row of supravibrissal setae on facial ridge ascending about halfway to antennal base (Fig. 5); only two postsutural intra-alar setae; lower calypter darker brown with pale rim and white fringe. Body length, males 9–10mm, females 10–11mm.

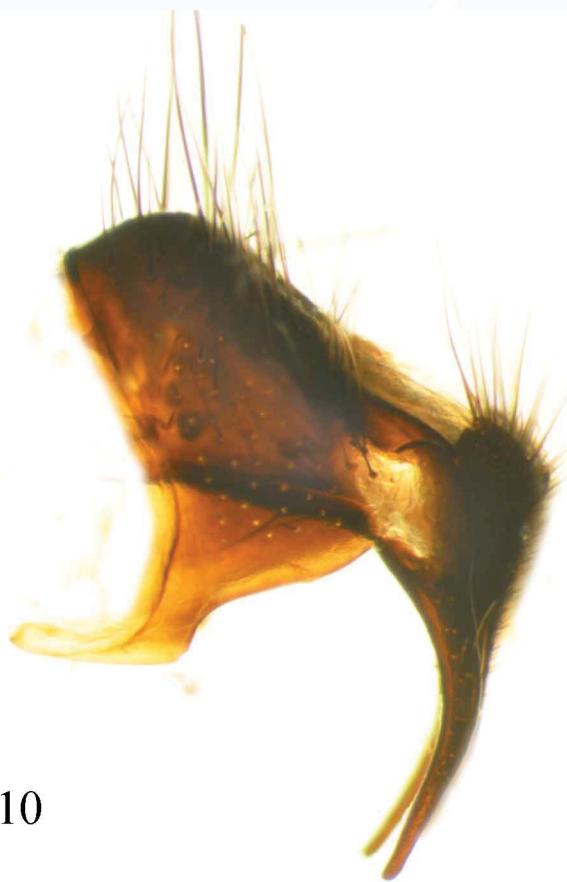
Male. Frons broad, at narrowest, 0.066 (0.06–0.07/5) of head width; 0.91 (0.91–0.92/5) of first flagellomere; parafacial at narrowest 1.6 (1.5–1.9/5) of frons; 1.44 (1.1–1.7/5) of first flagellomere; gena to eye ratio 0.57; frontal setae ascend to just below where fronto-orbital plates nearly meet; lateroclinate and proclinate setae absent; changeable spot on upper parafacial. Surstyli and cercus small and slender, surstyli longer than cercus (Figs. 10, 11). Phallus with acrophallus unusually broad in dorsal view (Figs. 18, 19); hypandrium, pre- and postgonites, ejaculatory sclerite and sternites as in Figs. 27–29, 37.



8



9



10



11

FIGURES 8–11. Left lateral and posterior views of male genitalia of *Calliphora* spp. epandrium, cerci and surstyli. **8, 9.** *C. irazuana*. **10, 11.** *C. lopesi*.

Female. Frons 0.32 (0.31–0.33/5) of head width at narrowest; 4.1 (3.7–4.4/5) of first flagellomere; parafacial at narrowest 0.42 (0.40–0.45/5) of frons; 1.7 (1.5–1.9/5) of first flagellomere; gena to eye ratio 0.52 (0.50–0.54/5); frontal setae ascend to anterior ocellus, proclinate and laterooclinate setae present. A changeable spot midway on fronto-orbital plate and another on upper parafacial. T5 without incision, sometimes with a v-shaped notch. Ovipositor and spermathecae as in Figs.41, 45, posterior margin of ST8 bifurcated.

Specimens examined. 10 males, 11 females. **Brazil** (9 males, 4 females): Rio Grande do Sul, Pelotas, 1 male, Aug. 4, 1956, C. Biezanko (BMNH); 1 female, June 29, 1963, J. Lucia Mantovani-Biezanko (BMNH); 5 males, 3 females, Rio de Janeiro, Alto Itatiaia, 2000m, March, 1941, R.C. Shannon, B.L. Gomes (USNM); 1 male, Nova Teutonia, 27°11'S 52°23'W, Oct. 1966, Fritz Plaumann (CNC); 1 male, same data, except Sept. 25, 1960; 1 male, Cruzeiro, Dec., 1962, F. Plaumann (CNC). **Uruguay** (1 male, 7 females): 1 female, Montevideo, J. Tremoler, Nov. 25, 1924 (USNM); 1 male, 6 females, Soriano, Cardona, 33°52'60"S 57°22'60"W, March 20, 2008, T.L. Whitworth (TW).

Distribution. Brazil and Uruguay, Fig. 2. Specimens from Uruguay were collected near the Argentinian border, and it is therefore likely that *C. lopesi* also occurs in Argentina. The species possibly occurs in nearby Paraguay, and maybe in other countries in the region. Specimens were found from near sea level to about 2000m.

Calliphora maestrica Peris, Gonzalez-Mora, Fernandez and Peris, 1998

See figs. 9–18 in Whitworth (2010).

Calliphora maestrica Peris, Gonzalez-Mora, Fernandez and Peris, 1998: 49; Whitworth, 2010:8.

Type information. Holotype female (IZAC). Type locality: Cuba, Santiago, Sierra Maestrica. Not examined.

Diagnosis. Basicosta reddish-orange, a *Calliphora* character state shared in the New World by only *Calliphora vicina*; anterior half of genal dilation brown to black, versus reddish to orange in *C. vicina*; two rather than three katepisternal setae (the condition in all other New World *Calliphora*); male frons exceptionally broad, 0.29 of head width, only slightly narrower than width of eye, almost as broad as female frons which is 0.33 of head width, male frons much narrower (0.075) in *C. vicina*. Male surstyli and cercus distinctive, surstyli triangular in shape in lateral view and forceps-like from rear, cerci fused and withdrawn into base of surstyli (Whitworth 2010, figs. 10, 11). Phallus distinctive, epiphallus originating near anterior end of basiphallus, curving forward at a 45° angle near tip, paraphallus ending in a curved hook that lacks serration (Whitworth 2010: figs. 12, 13). Hypandrium slender; pregonite unlike other species in region, with about 10 setae; postgonite, and ejaculatory sclerite as in Whitworth (2010, figs. 14–16). Male sternites unusual, ST5 very broad like in *C. nigribasis*, but composed of two separate sclerites rather than one (Whitworth 2010, fig.17). Female ovipositor unlike other *Calliphora* in the Neotropical Region (Whitworth 2010, fig. 18).

Description. This species was described in detail by Whitworth (2010).

Specimens examined. See Whitworth (2010) for details on specimens examined.

Distribution. Cuba, Dominican Republic, Jamaica (Whitworth 2010, fig.1).

Discussion. This species is known only from the West Indies; see Whitworth (2010) for a discussion of character states, distribution, and illustrations.

Calliphora nigribasis Macquart, 1851

Figs. 2, 7, 12, 13, 20, 21, 30–32, 38, 42, 46

Calliphora nigribasis Macquart, 1851: 215; Shannon, 1926: 134; Mariluis and Peris, 1985: 82; Peris and Gonzalez-Mora, 1989: 185.

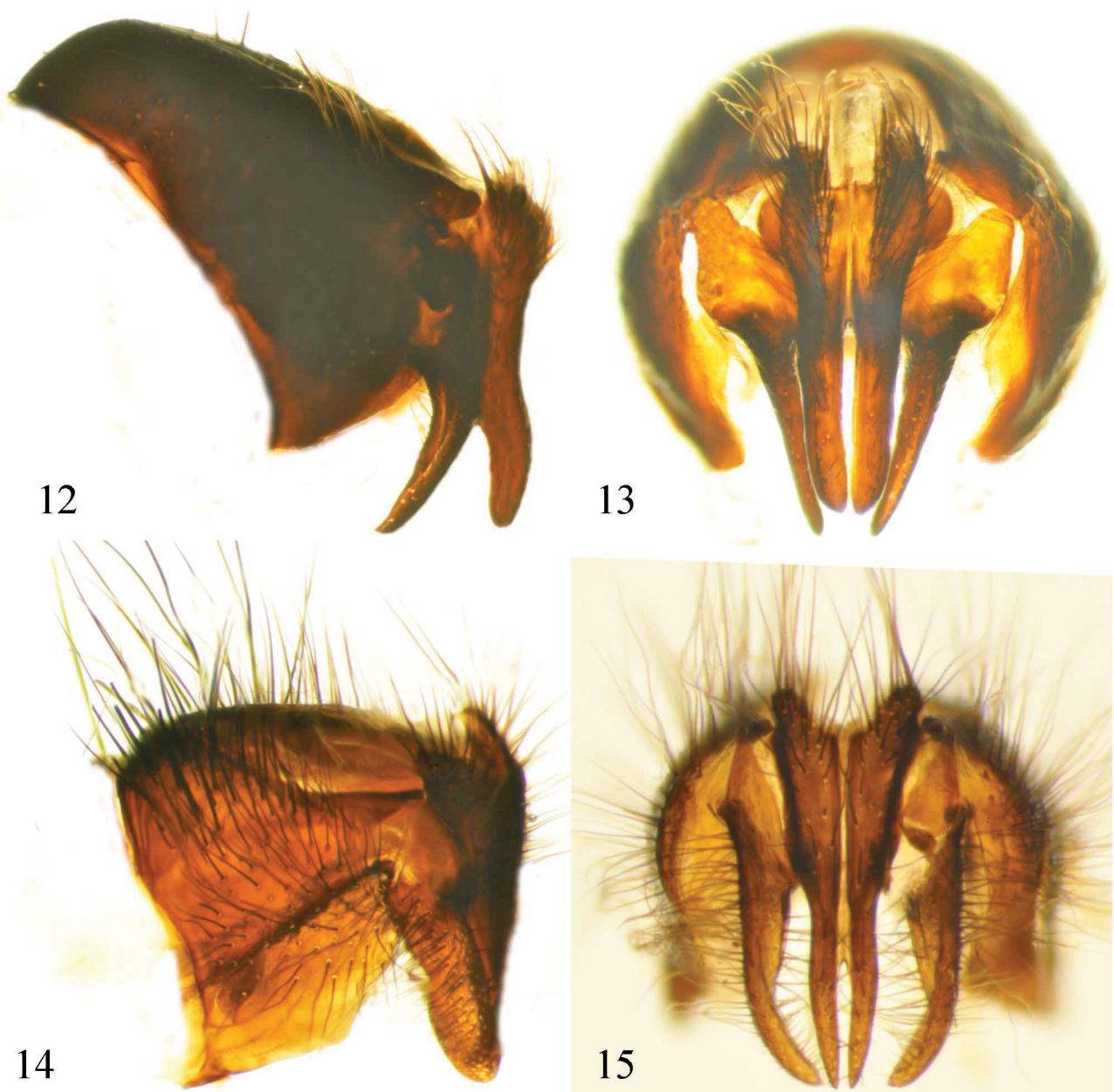
Calliphora peruviana: Hall, 1948: 301, plate 27 (figs. J, K) (in part; description of “peruviana” is that of a Neotropical *Calliphora* species whereas the figures show the male genitalia of *C. loewi*; see below under Type information); James, 1970: 12; Baumgartner and Greenberg, 1985: 583. The true *C. peruviana* Robineau-Desvoidy is treated here as a *Lucilia* species; see Appendix for details.

Calliphora peruviana: James, 1970: 12 (misidentification).

Calliphora nigra Mello, 1974: 59, **n. syn.**

Calliphora calcedoniae Mariluis, 1978: 51; Mariluis and Peris, 1985: 82 (synonymized with *C. nigribasis*).

Calliphora antojuanae Mariluis, 1982: 32, **n. syn.**



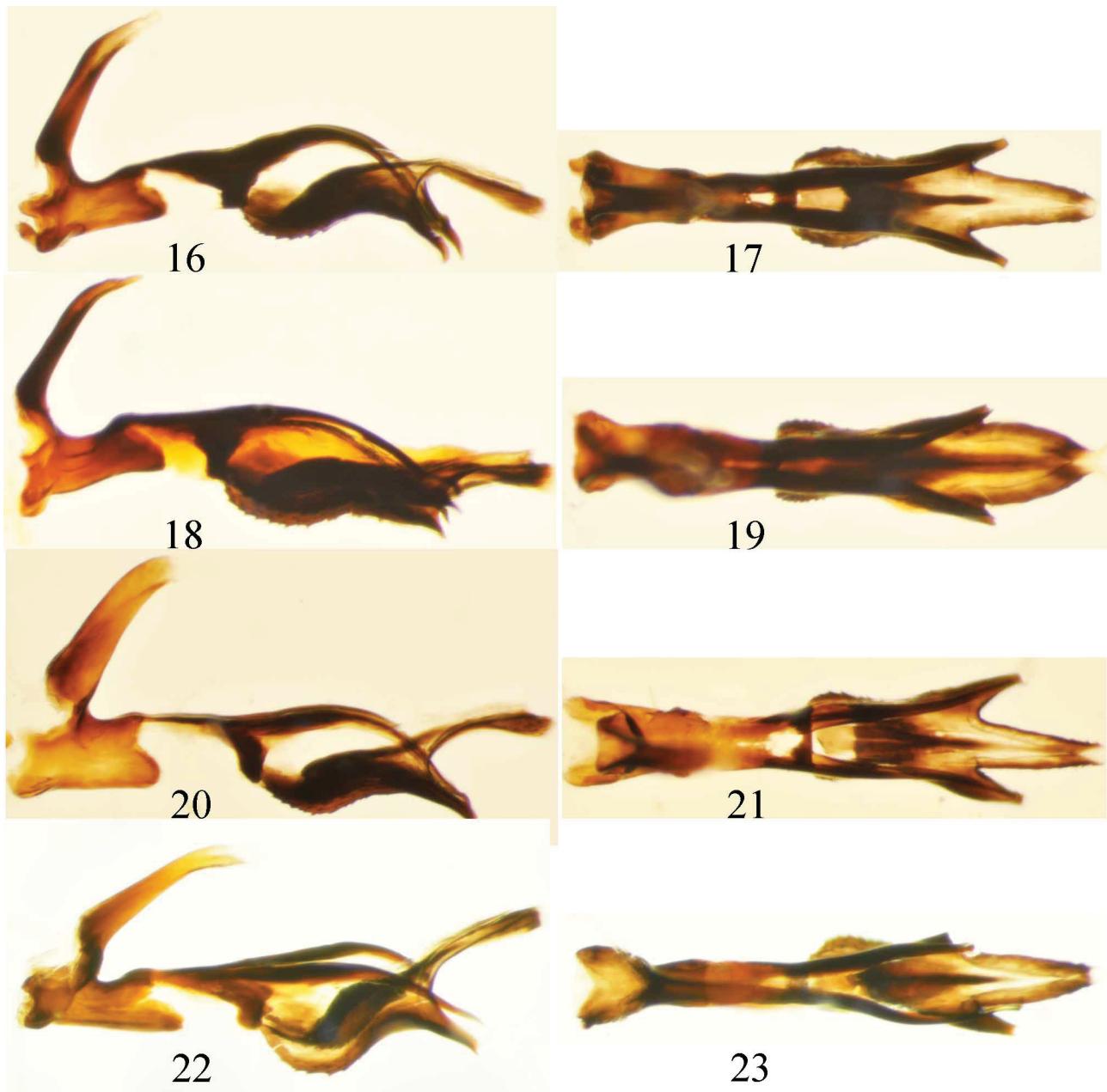
FIGURES 12–15. Left lateral and posterior views of male genitalia of *Calliphora* spp. epandrium, cerci and surstyli. **12, 13.** *C. nigribasis*. **14, 15.** *C. triseta*.

Type information. *Calliphora nigribasis* Macquart (1851: 215) was described from one or more males from “Columbie”. James P. Dear examined the single male in MNHN and recorded the label data as “Colombie Parzudacki 1842” (from Dear’s unpublished notes on the “holotype”; further details are given in Nomenclatural Summary in Appendix). Type not examined. Hall (1948: 301) erred in citing two syntypes in MNHN, a male and a female (the nominal species was described from the male sex only) and in reporting Mexico as the type locality given on the labels. My concept of this species follows that of Shannon (1926), Mariluis and Peris (1985), and Peris and Gonzalez-Mora (1989).

Calliphora nigra Mello (1974: 59) was described from two males and one female from Sur de Saraguro, Ecuador (including the male holotype and female allotype), and two females from a nearby location in Ecuador. Mello recognized the specimens as close to “*C. peruviana* R.-D.”, but he did not examine type material. He relied instead on Hall’s (1948) figures (plate 27, figs. J, K) of the genitalia of “*C. peruviana*” to conclude that his specimens were a different species. Hall’s (1948: 301) description of “*C. peruviana*” is that of a Neotropical *Calliphora* species, but

his figures are not those of the true *C. peruviana* (which is a *Lucilia* species, see Appendix). Neither are they *C. nigribasis*, which Hall treated as a synonym of *C. peruviana*. They appear to be the Holarctic species *C. loewi* Enderlein, 1903, which Hall recognized as a valid species under the name *C. morticia* Shannon, 1923 (misspelled as “*mortica*” by Hall). *Calliphora morticia* was synonymized with *C. loewi* by Rognes (1991) and the latter was treated as a valid North American species by Whitworth (2006). The genitalia in Mello’s figures of *C. nigra* closely resemble the genitalia of *C. nigribasis* figured herein (Figs. 12, 13), and on this basis I consider *C. nigra* a synonym of *C. nigribasis*, **new synonymy**.

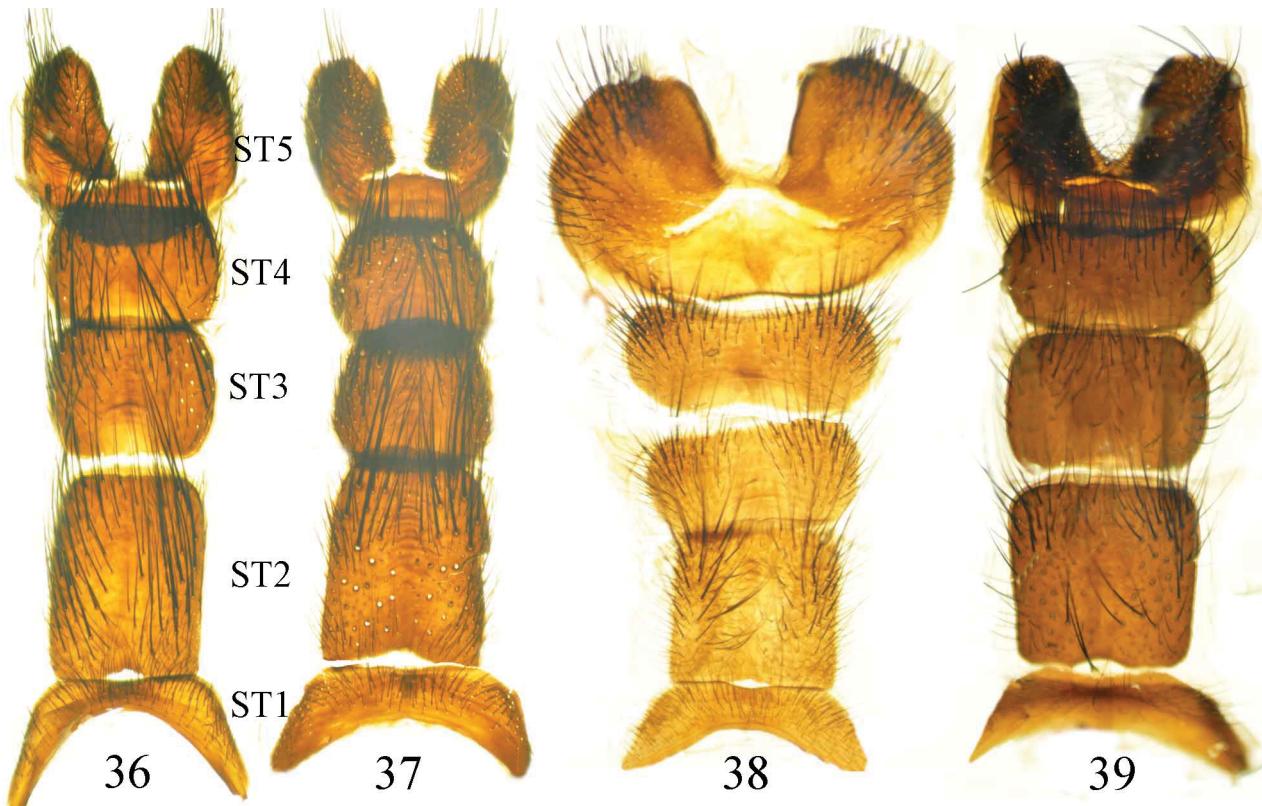
Calliphora antojuanae Mariluis (1982: 32) was described from a female holotype and two female paratypes from Pampa de Achala, near Cordoba, Argentina. The ovipositor sclerites of *C. antojuanae* shown in Mariluis’ figures are very similar to those of *C. nigribasis* illustrated herein (Figs. 12, 13) and on this basis I consider *C. antojuanae* a synonym of *C. nigribasis*, **new synonymy**.



FIGURES 16–23. Phallus of *Calliphora* species in left lateral and dorsal views. **16, 17.** *C. irazuana*. **18, 19.** *C. lopesi*. **20, 21.** *C. nigribasis*. **22, 23.** *C. triseta*, guide is damaged on right side (Fig. 23).



FIGURES 24–35. Hypandria, pre- and postgonites, and ejaculatory sclerites of male *Calliphora*. 24–26. *C. irazuana*. 27–29. *C. lopesi*. 30–32. *C. nigribasis*. 33–35. *C. triseta*.



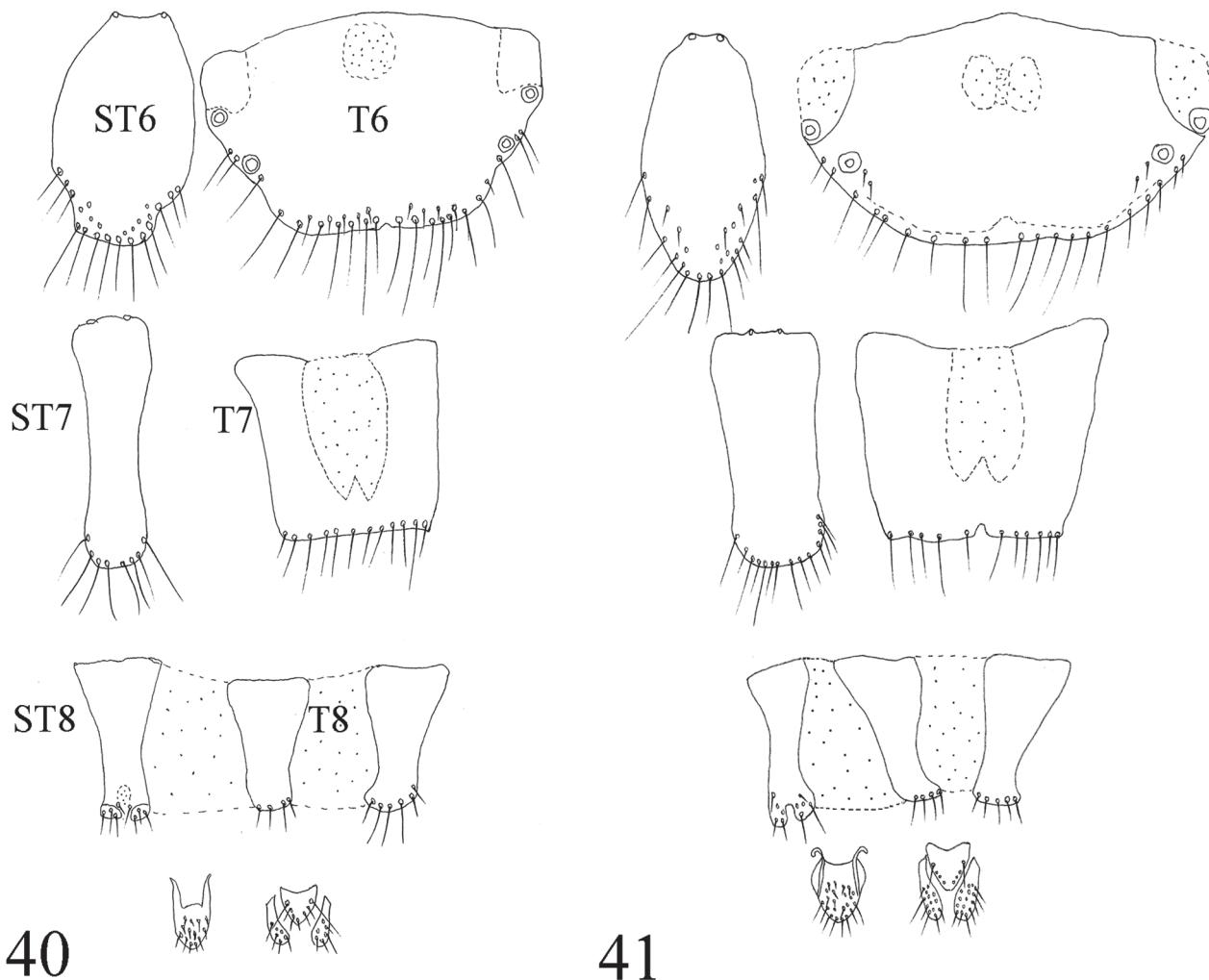
FIGURES 36–39. Ventral view of male abdominal sternites of *Calliphora*. **36.** *C. irazuana*, segments labeled. **37.** *C. lopesi*. **38.** *C. nigribasis*. **39.** *C. triseta*.

Diagnosis. Known primarily from high elevations in Argentina, Bolivia, Colombia, Ecuador, and Peru. Baumgartner and Greenberg (1985) recorded a specimen from 5008m. A specimen collected in Peru listed as found at 400ft may be an error. *Calliphora nigribasis* can be separated from *C. lopesi*, the only similar species in the region, as follows: *C. nigribasis* usually with black genal groove versus orange in *C. lopesi*; rim of lower calypter and fringe reddish brown to brown versus white; male frons 0.102 (0.09–0.12/5) of head width versus 0.066 (0.06–0.07/5); frons broader than first flagellomere versus narrower; surstylus and cercus shorter and broader versus longer and more slender; ST5 of male very broad (Fig. 38) versus normal width (Fig. 37).

Description. Lower parafacial usually reddish; upper parafacial, genal dilation, genal groove and fronto-orbital plate usually brown to black with silvery microtomentum; upper parafacial with a more or less distinct changeable spot; frontal vitta reddish to reddish brown; pedicel brown, apical edge orange, first flagellomere brown, basal portion reddish; occiput with a weak row of dark setae below strong postocular row, remainder of occiput with pale, silvery setae which can be seen just above the postgena; ocellar triangle medium in size, anterior ocellus usually slightly larger than posterior ocelli; facial ridge with row of strong supravibrissal setae on facial ridge ascending about 2/3 of way to antennal base; only two postsutural intra-alar setae; anterior and posterior thoracic spiracles brown; upper and lower calypters brown with brown to reddish brown fringe. Body length, males 9–10mm, females slightly longer, 10–12mm.

Male. Frons broad, 0.102 (0.09–0.12/5) of head width at narrowest, clearly broader than width of first flagellomere; 1.5 (1.4–1.8/5) of first flagellomere; parafacial at narrowest 1.2 (1.0–1.3/5) of frons; 1.9 (1.7–1.9/5) of first flagellomere; gena to eye ratio 0.55 (0.50–0.58); frontal setae long and dark, ascending to just below median ocellus; fronto-orbital plates broad, almost meeting just anterior to ocellar triangle; upper parafacial with a changeable spot. Surstylus in lateral view short and relatively broad (Fig. 12), cercus in posterior view broad and slightly shorter than surstylus (Fig. 13). Phallus, hypandrium, pre- and postgonite, and ejaculatory sclerite as in Figs. 20, 21, 30–32. Sternites 3 and 4 slightly expanded, ST5 (Fig. 38) about twice the width of other species, except for *C. maestrica* (Whitworth 2010, fig. 16).

Female. Frons 0.34 (0.32–0.36/5) of head width at narrowest; 5.4 (4.8–5.8/5) of first flagellomere; parafacial at narrowest 0.44 (0.40–0.47/5) of frons; 2.3 (2.1–2.5/5) of first flagellomere; gena to eye ratio 0.65 (0.62–0.68/5). A changeable spot midway on fronto-orbital plate and another on upper parafacial. T5 sometimes with a notch on the rear margin, but no incision. Ovipositor and spermathecae as in Figs. 42, 46.



FIGURES 40–41. Ovipositors of *Calliphora*. **40.** *C. irazuana*, sclerites labeled. **41.** *C. lopesi*.

Specimens examined. 60 males, 25 females. **Argentina** (3 males): 1 male, Catamarca Province, Sierra de Ambro, 13 km nw Chumbica, 28°50'00"S 66°24'46"W, 700m, June 15, 1999, M.E. Erwin, F.D. Parker (USU); 1 male, Catamarca, Cuesta Totoral, 1300m, Nov. 27, 1968, L.E. Peña (CNC); 1 male, same data, except 6 km N. Aconquija, 1700m, Oct. 2, 1968. **Bolivia** (35 males): 2 males, El Limbo, Chapare Province, 65°36'W 17°07'S, 2200m, Nov. 1963, F. Steinbach (CNC); 1 male, same data, except Nov.–Dec., 1964; 2 males, same data, except Jan., 1964; 1 male, Chipiriri, Sept., 1962, T. Steinback (CNC); 1 male, Chapare Yungas, Feb. 1–3, 1976, 2200m, L.E. Peña (CNC); 1 male, Sillutincata, Yungas de La Paz, Jan. 20, 21, 1976, 2200–3000m, L.E. Peña (CNC); 1 male, Siberia W. Comarapa, Coch., Feb. 18, 19, 1976, 2500–2900m, L.E. Peña (CNC); 1 male Crystal Mayo, May, 1963, no collector (CNC); 3 males, Paracti, Chapare, 2200m, Feb. 1–4, 1976, L.E. Peña (CNC); 1 male, Chapare Province, M. Grunbaum, purchased 1966 (NHMLA); 1 male, 50 km w Chuliman, Nov. 26, 1951, Ross and Michelbacher (WSU); 1 male, Cochabamba Department, El Limbo, Nov. 1962, F.H. Walz (WSUP); 4 males, La Paz Department, La Paz, Oct. 4, 1972, G.E. Bohart (USU); 1 male, Cochabamba Chapare, Villa Tunari; Cochabamba Road, km 365, Dec. 9, 1996, 1800m, G. & M. Wood; 1 male, same data except km 396, Dec. 10, 1996, 2750m (CNC). **Colombia** (4 males, 3 females): 1 male, Bogota, B. Guevara Coll. (USNM); 2 males, Bogota, Feb.–Apr., 1915, Dr. A. Balfour, 1915-298; 1 male, 2 females, Villavicencio, Guatiquia Riv., 400ft, Nov-Dec., 1914 (BMNH);

1 female, D. Balfour, ex. Wellcome Coll., B.M. 1990-107 (BMNH). **Ecuador** (7 males, 13 females): 1 male, 1 female, Napo, 43 km, W. Baeza, 3500m, March 4–7, 1976, G.E. Shewell (CNC); 2 males, Tarqui, Azuay, 2800m, March 16, 1965, L. Peña (CNC); 1 female, Pichincha, $0^{\circ}26'S 70^{\circ}40'W$, April 4, 1976, G.&M. Wood (CNC); 1 female, km 52, S. of Cuenca, 3250m, March 21, 1965, L. Peña (CNC); 3 females, San Isidro, Carchi, 2500m, June 23, 1965, L. Peña (CNC); 4 females, Cerro Tinajillas, Azuay, March 18–21, 1965, 1965, 3100m, L. Peña (CNC); 1 female, Pichincha province, Latacunga, Machachi, 3400m, May 12, 1976, flight trap, G.B. Fairchild (FSCA); 3 males, 2 females, Napo, 8.5 km E. Papallacta, March 29, 1983, G.& M. Wood; 1 male, same data except March 26, 1983, 8.7 km E. of Papallacta (CNC). **Peru** (10 males, 9 females): 1 male, Acolla District, cerca Jauja, 3460m, June, 1948, F. Blancas (WSUP); 1 male, Arequipa Department, Arequipa, 2500m, July 17, 1980, M. Szyska, B. Greenberg (BG); 1 male, Huanuco Department, 10 miles sw Las Palmas, 1000m, Sept. 17, 1954, E.I. Schlinger, E.S. Ross (WSUP); 1 female, Huarochiri Province, Chicla, March 9, 1977, B. Greenberg (BG); Junin Department; 1 male, Chuquisaca, June 21, 1980, D. Baumgartner, B. Greenberg (BG); 1 female, Huasahuasi, June 16, 1980, 2750m, fish and liver bait, B. Greenberg (BG); 2 males, 2 females, Junín Department, La Oroya, Dec. 12, 1979, M. Szyska (GB); 2 females, Palca, 2739m, June 17, 1980, D. Goodwin, B. Greenberg (BG); 2 males, 1 female, Queropuquio, 4177m, June 20, 1980, M. Szyska (BG); 1 female, Lima Department, Tambo de Viso, 2652m, Dec., 1981, D. Baumgartner (TAMU); 1 male, Lima Department, Matucana, June–July, 1913, 7300ft, C.T. Brues (USNM); 1 male, Tarma Province, Dec. 14, 1977 (BG), 1 female, Tincocha, Aug., 1911, Yale Peruvian Expedition (USNM). **Venezuela**: 1 male, Caracas, Sheraton Humboldt Hotel, Dec. 9, 1970, J.W. Boyes (CNC).

Distribution. Argentina, Bolivia, Colombia, Ecuador, Peru. Baumgartner and Greenberg (1985) listed this species from these countries (as *C. peruviana*) as well as from Mexico and Costa Rica (Fig. 2). *Calliphora nigribasis* does not occur in the latter two countries; records of this species from those areas are likely based on misidentified *C. irazuana* or *C. triseta*. Baumgartner and Greenberg (1985) commented that in Peru *C. nigribasis* is eurythermal, occurring over a wide range of habitats from low montane to snowy upper areas above 1300m on eastern slopes and above 2650m on western slopes. They also reported a specimen taken at 5008m. They considered *C. nigribasis* hemisynanthropic, and found it around man as well as in remote undeveloped areas.

Discussion. The external features of this species can overlap with those of *C. irazuana* in the key, see discussion under *C. irazuana*. Normally the strong third postsutural intra-alar seta in *C. triseta* and distinct male genitalia will readily separate them.

Hall (1948) used *C. peruviana* Robineau-Desvoidy as the valid name for this species. Later, Mariluis and Peris (1985: 82) used *C. nigribasis* as the valid name, rejecting the former use of Robineau-Desvoidy's name *C. peruviana*. The identity of *C. peruviana* is discussed in detail in the Appendix. Macquart (1851: 216) also described a *Calliphora peruviana*. It is not a *Calliphora*, it is *Neta chilensis* (Walker, 1837) (see Appendix).

Calliphora triseta sp. nov.

Figs. 1, 3, 6, 14, 15, 22, 23, 33–35, 39, 43, 47, 48–50

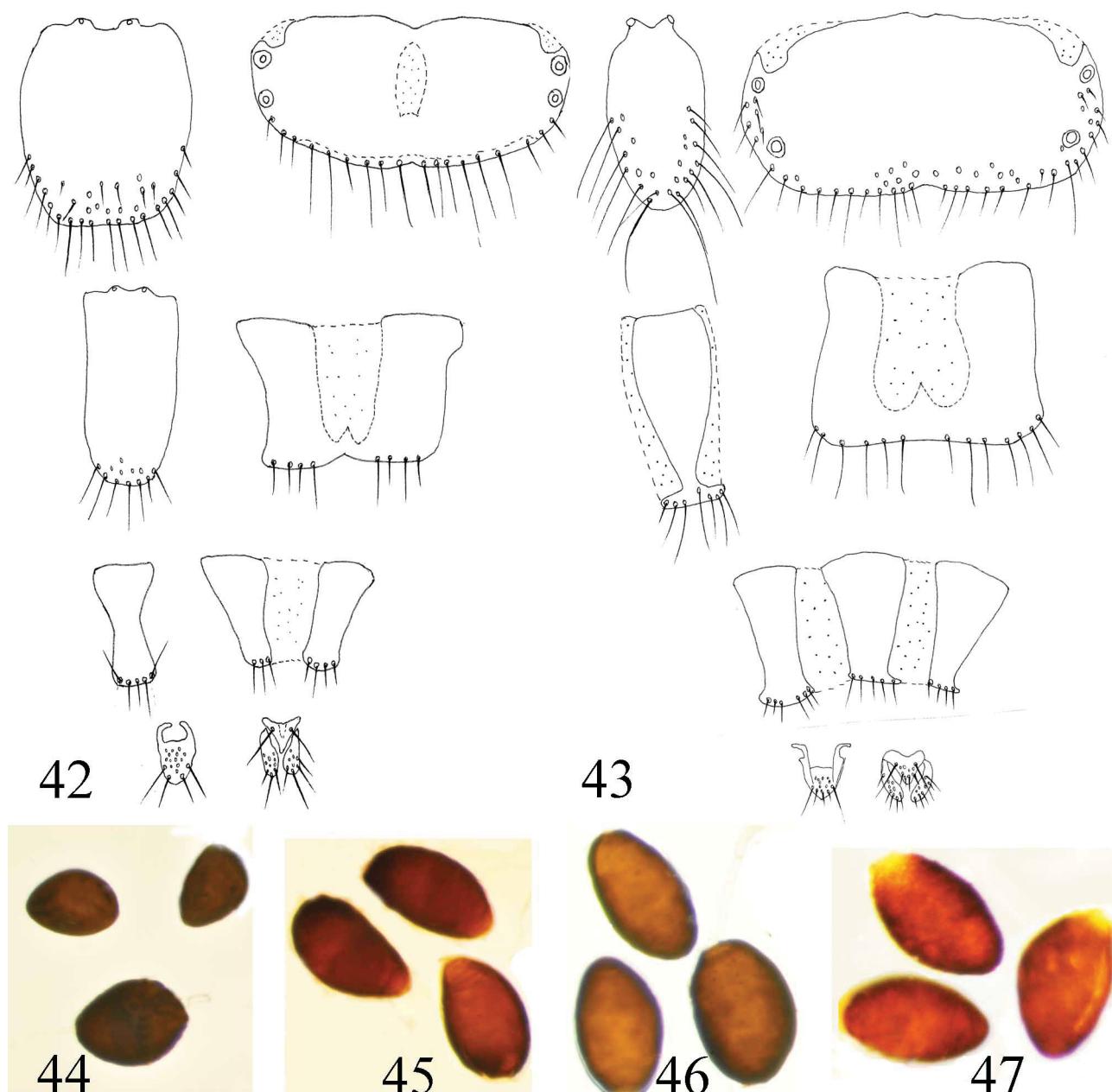
Diagnosis. See diagnosis of *C. irazuana* for comparison of characters. Three postsutural intra-alar setae, the one closest to the suture (Fig. 50, arrow) strong; lower calypter usually with rim and setal fringe whitish, especially on proximal end (rarely tan in color), also whitish in *C. lopesi*, but geographical ranges do not overlap; genal dilation wholly black to dark brown. Male frons narrow, 0.035 head width; surstylus broad in lateral view (Fig. 14), cerci often Y-shaped in posterior view (Fig. 15, Y-shape not prominent in this photo). T5 of female abdomen lacks incision. Known only from Costa Rica, El Salvador, and Mexico, likely found in other Central American countries at higher elevations.

Description. Parafacial, fronto-orbital plate, genal dilation, and frontal vitta all black to dark brown or rarely reddish brown when viewed from below; from above, parafacial, fronto-orbital plate and genal dilation with silvery microtomentum; upper parafacial and lower fronto-orbital plate each with a changeable spot; pedicel brown but apical rim usually orange; basal portion of first flagellomere orange, the remainder brown to orange-brown; occiput below postocular setae with 3–4 irregular rows of dark setae, the remainder of occiput with long whitish setae; ocellar triangle small, anterior ocellus and posterior ocelli about equal in size; facial ridge with row of strong supravibrissal setae ascending about 80% of way to antennal base. Thorax normally with three prominent postsutural intra-alar setae, the anteriormost seta sometimes reduced, rarely absent. Anterior spiracle dull orange to light brown, posterior spiracle sooty black. Upper calypter brown in center, lighter near edges, rim and fringe brown;

lower calypter all brown, rim and fringe usually pale, more whitish at distal end (Fig. 3); about 10% of specimens examined with rim and fringe tan in color. Normal body length of males 9–10mm, females 9–12mm.

Male. Frons narrow 0.031 (0.030–0.035/5) head width at narrowest; 0.42 (0.38–0.46/5) of first flagellomere; parafacial at narrowest almost 3x frons width, 2.7 (2.5–3.0/5); 1.18 (1.0–1.36/5) of first flagellomere; gena to eye ratio 0.42 (0.40–0.42/5). Two changeable spots on parafacial, one at upper end, one about midway. Surstylus broad and digitate in lateral view (Fig. 14); in posterior view, base of cerci broad, tapering to narrower distally, the distal third of cerci often meeting in a y-shape; cerci and surstyli about equal length (Figs. 15). Phallus with epiphallus angling downward more sharply than in other species (Fig. 22, 23). Hypandrium, pre- and postgonite, ejaculatory sclerite and sternites as in Figs. 33–35, 39.

Female. Frons 0.33 (0.31–0.34/5) of head width at narrowest; 3.36 (2.9–4.2/5) of first flagellomere; parafacial at narrowest 0.39 (0.36–42/5) of frons; 1.32 (1.1–1.6/5) of first flagellomere; gena to eye ratio 0.57 (0.54–58/5). Two changeable spots on parafacial like male, one midway on fronto-orbital plate not present in males. Ovipositor and spermathecae as in Figs. 43, 47; posterior end of ST7 with a narrow neck-like constriction similar to *C. vicina*.



FIGURES 42–47. Ovipositors and spermathecae of *Calliphora*. 42, 43. Ovipositors. 42. *C. nigribasis*. 43. *C. triseta*. 44–47. Spermathecae. 44. *C. irazuana*. 45. *C. lopesi*. 46. *C. nigribasis*. 47. *C. triseta*.



48



50

San Gerardo de Dota, 2000
-2500m, Prov. San Jose,
Costa Rica, Curso
Tachinidae y Syrphidae
22-26 feb 1992
L-S 387400, 482700

COSTA RICA



INBIO
CRI000
405809

HOLOTYPE

Calliphora triseta
T.L. Whitworth

49



51

FIGURES 48–51. 48. Holotype male of *C. triseta*. 49. Holotype labels for *C. triseta*. 50. Dorsal view of left portion of thorax (anterior to right), arrow points to the first of three postsutural intra-alar setae in *C. triseta*. This seta is normally lacking in other Neotropical *Calliphora* species. 51. Labels associated with the holotype female of *C. irazuana*.

Type material. Holotype male from Costa Rica, San Jose Province, San Gerardo de Dota, L_S_387400_482700, 2000–2500m, Curso Tachinidae y Syrphidae, Feb. 22, 1992, no collector given (Figs. 48, 49). Allotype female, Costa Rica, San Jose Province, Llano Bonito, 4.4 km S del Cerro Ventisquero, L_S_378500_513200, 2450m, April 9, 1996, M. Segura. Paratypes from Costa Rica, El Salvador and Mexico are listed below. Holotype and allotype will be deposited in INBIO. Paratypes will be deposited at BMNH, BYU, CNC, TW, USNM, and USU.

Paratypes. 55 males, 78 females. **Costa Rica** (50 males, 74 females). **Alajuela Province:** 1 female, Rio Poasito at Poasito, May 10, 1995, Baumann and Houseman (BYU). **Cartago Province:** 2 males, 1 female, El Guarco, P.N. Tapanti, Estacion La Esperanza, 2800m, L_S_186143_531307, Jan. 13, 2005, A. Martinez (INBIO); 2 females, Estacion Ojo de Aqua, L_S_396800_482400, 2980m, Dec. 9, 1997, E. Alfaro (INBIO); 1 female, Cartago

Province, Cerro de la Muerte, Paramo, L_S_395114_488901, 3100m, May 20, 1997, F.A. Quesada (INBIO); 2 females, P.N. Volcan Irazu, 3400m, L_S_218500_552200, Jan.-Feb, 1993, G. Maass (INBIO); 1 female, Finca Genesis II, Area de Conservacion Amistad, 2300m, L_S_188600_545900; June 9–10, 1994, M.A. Zumbado (INBIO); 1 female, 20 km SE Empalme, 2800m, Oct.–Nov., 1988, Hanson (INBIO); 1 female, Cerro de la Muerte, Villa Mills, 3000m, Jan–March, 1990, Hanson (INBIO). **Heredia Province**: 5 females, Estacion Barva, P.N. Braulio Carrillo, 2500m, L_S_233400_523200, Nov., 1989, G. Fernandez (INBIO); 2 females, same as previous, except April, 1989, M. Zumbado, A. Fernandez; 1 female, same as previous, except G. Rivera collector; 4 females, same as above except March, 1990; 4 females, same as above except March, 1990; 1 female, same as above except April, 1990; 2 females, same as above, except Feb., 1990, G. Rivera; 5 males, same as above, except Jan.; 1 male, same as above, except Oct. 1989, G. Rivera, G. Fernandez; 1 female, Barva Volcano, 2900m, $10^{\circ}70'10''N 84^{\circ}87'50''W$, Jan. 15, 2011, T.L. Whitworth (TW). **Limon Province**: 1 male, Sendero Valle del Silencio al Jardin Botanico o Natural, 2400m, L_S_342300_577200; April 17–20, 1996, M. Moraga (INBIO); 1 male, P. Int. La Amistad Sendero Circular, 2406m, L_S_340258_577465, June 20, 2003, D. Rubi (INBIO); 1 male, P. Int., La Amistad Send. Circular, 2450m, L_S_340258_577465, June 23, 2003, R. Gonzales (INBIO); 1 male, Valle del Silencio, Zona de Acampar, 2450m, L_S_341250_577200, April 16, 1996, A.M. Maroto (INBIO); 1 female, Valle del Silencio, al Jardin Botanico o Natural, 2480m, L_S_342300_577200, April 17–20, 1996, M. Moraga; 1 female, P. Int. La Amistad, 2500m, L_S_340258_577465, June 27, 2003, D. Rubi (INBIO); 1 female, P. Int. La Amistad, 1 km de Cerro Kamuk, 3583m, L_S_357800_569681, April 15, 2002, M. Alfaro (INBIO); 1 female, P.N. La Amistad Bratsi, Cerro Nai, 3129m, L_S_352300_564950, July 20, 2000, M. Alfaro (INBIO). **Puntarenas Province**: 1 male, Quijada del Diablo, 3.1 km NE de Mellizas, 1800m, L_S_316900_600600 Sept. 14–23, 1996, E. Navarro (INBIO); 1 male, Tres Colinas, Potrero Gde., Buenos Aires, 1850m, L_S_340700_566400, July 22, 1992, M.A. Zumbado (INBIO); 2 males, P. Int. La Amistad, Buenos Aires, 1700m, L_S_331750_574400, April 27, 2001, O. Aleman (INBIO); 1 female, Sendero a Cerro Echandi, 2600m, L_S_329700_593100, April 12–14, 1998, M.M. Moraga, (INBIO); 1 female, La Amistad Send. hacia Cerro Hoffman, 2450m, L_S_337931_575490, June 24, 2003, R. Gonzales (INBIO); 1 female, La Amistad, Buenos Aires, Sendero a Cerro Cabecar, 2400M, L_S_365750_532600, M. Alfaro. **San Jose Province**: 24 males, San Gerardo de Dota, 2000–2500m, L_S_387400_482700, Feb. 22–26, 1992, no collector (INBIO); 4 males, Estacion Cuerici, Sendero el Carbon, 5 km al E de Villa Mills, L_S_390100_500100, Jan. 8–13, 1996, A. Picado (INBIO); 1 male, same data as above except collector, B. Gamboa (INBIO); 3 males, Llano Bonita, 4.4m s, del Cerro Ventisquero, 2450m, L_S_378500_513200, April 19, 1996, A. Picado (INBIO); 1 male, 4.6 km Villa Mills, Estacion Cuerici, Sendero al Mirador, 2700m, L_S_389700_499600, Oct. 25, 1995, A. Picado (INBIO); 1 male, Estacion Cuerici, 4.6 km al E de Villa Mills, 2700m, L_S_389700_499600, Nov. 28, 1995, A.M. Maroto (INBIO); 1 female, S Herradura-Uran, 3000m, L_S_387832_509027, April 8, 1995, R. Aquilar, O. Esquivel (INBIO); 1 female, Sendero Valle Los Leones, 1.6 km N del Cerro Lohmann, 3180m, L_S_374700_517500, April 13, 1996, M. Segura (INBIO); 1 female, Perez Zeledon, P.N. Chirripo, Llano Bonito, 2450m, Feb. 3, 2001, M. Alfaro, (INBIO); 1 female, alrededor base Crestones, 3200m, L_S_378300_517200, July 17, 1998, M.A. Zumbado, F.G. Zumbado, H. Vargas (INBIO); 1 female, Estacion Ojo de Aqua. Camino a Providencia, 2900m, L_S_394400_482300, June 24, 1998, E. Alfaro; 2 females, Estacion Cuerici, Sendero el Carbon, 5 km al E de Villa Mills, 2700m, L_S_390100_500100, Jan. 8–13, 1996, A. Picado (INBIO); 1 female, Llano Bonito, 4.4 km S del Cerro Ventisquero, 2450m, L_S_378500_513200, April 9, 1996, E. Alfaro (INBIO); 1 female, Estacion Cuerici, alrededores de la Estacion, 2600m, L_S_389400_499600, Aug. 20–28, 1995, A. Picado (INBIO); 1 female, Estacion Cuerici, Limite de la Finca Cuerici, 3 km E Villa Mills, 2800m, L_S_389500_498600, Jan. 4, 1996, B. Gamboa (INBIO), 1 female, Estacion Cuerici, Camino a la Auxilladora, 4.5 km E de Villa Mills, 2600m, L_S_389400_499600, Jan. 6–12, 1996, A. Picado (INBIO); 1 female, Sendero el Carbon Camino Quebrada Los Leones, 5 km al E de Villa Mills, 2600m, L_S_389500_500050, Aug. 22, 1996, A. Picado (INBIO); 1 female, Gerardo de Dota, 2000–2500m, L_S_387400_482700, 22–28 Feb., 1992, no collector (INBIO); 1 female, Estacion Cuerici, Sendero el Carbon, 5 km al E de Villa Mills, 2700m, L_S_390100_500100, Feb. 17–19, 1996, B. Gamboa (INBIO); 1 female, Finca. Zacatales, 2100m, L_S_389000_484300, Aug. 8–10, 1995, M.A. Zumbado (INBIO); 1 female, Estacion Cuerici, el Mirador 4.6 km al E de Villa Mills, 2640M, L_S_389700_499600, Jan. 19, 1996, A. Picado (INBIO); 1 female, same as previous except 2600m, L_S_389400_499600, Sept. 21–26, 1995, B. Gamboa; 1 female, same as previous except 2700m, Oct. 25, 1995, B. Gamboa; 1 female, same as previous except 4 km, 2900m, March 17, 1996; 1 female, same as previous except 4.5 km, L_S_390345_500100, Dec. 7, 1995, A. M. Maroto; 3 females, Cerro Muerte, 20 km S

Empalme, 2800m, Nov.-Dec., 1989, Hanson (INBIO); 1 female, Cerro de la Muerte, Hy, Aug. 14, 1966, 9500ft, D.F. Veirs (USU); 1 female, Estacion Cuerici, Sendero el Carbon 5 km al E de Villa Mills, 2600m, L_S_390100_500100, Oct. 26, 1995, B. Gamba (INBIO); 1 female, Tres de Junio, 9°39'80"N 83°51'30", 2675m, Jan. 16, 2011, T.L. Whitworth (TW); 1 female, Estacion Cuerici, El Mirador en Subparamo, 4 km al E Villa Mills, 2900m, L_S_390450_500100, Jan. 12, 1996, A. Picado (INBIO); 1 female, Cerro Cuerici, 8 km al NE de Villa Mills, 3345m, L_S_392300_503200, Sept. 19, 1995, A. Picado (INBIO); 1 female, same as above except, L_S_392300_503300, Jan. 7, 1996, B. Gamboa (INBIO); 1 female, 20 km SE Empalme, 2800m, Aug. 1988, Hanson (INBIO); 2 females, Estacion Cuerici, Sendero el Carbon 5 km al E de Villa Mills, 2700m, L_S_390100_500100, Feb. 17-19, 1996, B. Gamboa (INBIO); 1 female, Estacion Cuerici (Alrededor) 4.6 km al E de Villa Mills, 2600m, L_S_389400_499600, A.M. Maroto; 2 females, Cuerici, Sendero al Cerro Cuerici, 4 km al E de Villa Mills, L_S_389700_499800, Oct. 27, 1995, A. Picado (INBIO); 1 female, Estacion Cuerici, Sendero al Mirador, 4.6 km al E de Villa Mills, 2700m, A. Picado (INBIO); 1 female, same as previous except L_S_389700_499600, Oct. 25, 1995; 1 female, same as previous except L_S_399400_499600, 2600m, Jan. 6-12, 1996, B. Gamboa; 1 female, same as previous except L_S_390450_500100, Oct. 26, 1996; 1 female, Estacion Cuerici, Limite de la Finca. Cuerici, 3 km E Villa Mills, 2800m, L_S_389500_498600, Jan. 4, 1996, A. Picado (INBIO); 1 female, Corralar Arriba, Sta. Ana, 1700m-1850, L_S_207000_516000, April 9, 1994, M.A. and F.G. Zumbado, H. Vargas (INBIO). **El Salvador:** 1 male, 2 females, Santa Ana, Aug. 16, 1956, PAB, collector (USNM). **Mexico:** (4 males, 2 females): 1 male, Oax., 32 mi S. Valle Nacional, 7000ft, May 21, 1971, H.F. Howden (CNC); 1 male, Chiapas, Mt Tzontehuitz, May 27, 1969, H.J. Teskey (CNC); 1 male, Chiapas, Mt. Tzontehuitz, 9400ft, 12 mi NE San Cristobal, May 27, 1969, B.V. Peterson (CNC); 1 male and 1 female, May 7 and June 25, 1969, respectively, Chiapas, 10km, NE San Cristobal, Mt Tzontehuitz, 2910m, Sept. 16, 1991, D.M. Wood (CNC); 1 female, 10 W El Salto, Dgo., 9000ft, June 5, 1964, J.F. McAlpine (CNC); 1 female, Chiapas, Mt. Tzontehuitz, 12 mi NE San Cristobal, 9400ft, June 25, 1969, B.V. Peterson (CNC).

Other material examined. Some specimens were discolored, distorted or damaged and were not treated as paratypes; these included 21 specimens (3 males and 18 females) from Costa Rica (INBIO).

Distribution. Costa Rica, El Salvador, and Mexico, and likely in mountainous areas throughout Central America and southern Mexico (Fig. 1). This species occurs in some of the same areas where *C. irazuana* is found; see discussion under that species. Most specimens were collected from 2000-3300m. Based on numerous *Calliphora* that have been collected in Costa Rica and deposited at INBIO, it is less common than *C. irazuana*.

Discussion. This species is normally easily separated from *C. irazuana* because of its black genal groove and parafacial in addition to the extra postsutural intra-alar. However, a few specimens may have the extra seta reduced or rarely absent. In one specimen the head had an orange genal groove and lower parafacial, but pale setae on the occiput and thorax with a distinct third postsutural intra-alar. It is possible this reflects hybridization. Male genitalia readily separate this species from *C. irazuana*.

Etymology. The species name was chosen due to the presence of a pronounced third postsutural intra-alar seta, a condition unique to this species of *Calliphora* in the Neotropical Region.

Calliphora vicina Robineau-Desvoidy, 1830

See Figs. 1, 2 and figs. 132, 139-148 in Rognes (1991)

Calliphora vicina Robineau-Desvoidy, 1830: 435; Hall, 1948: 307; Mello, 1962: 264; James, 1970: 102; Vargas and Wood, 2010: 1303; Whitworth, 2010: 10.

Type information. Holotype female (OUMNH). Type locality: USA, Pennsylvania, Philadelphia. Not examined.

Diagnosis. Basicosta yellow to orange; anterior half of genal dilation reddish; frons narrow, averaging 0.075 head width; see discussion under *C. maestrica* for other distinctions. Surstylus in lateral view, parallel-sided; in posterior view cercus tapering gradually to distal end (Rognes 1991, figs. 140, 141); surstylus and cercus about equal length. See figures of phallus, pre- and postgonite, ejaculatory sclerite, and sternites in Rognes 1991, figs. 143, 144, 145, 146. Ovipositor illustrated in Rognes 1991, fig. 148, ST8 with narrow neck similar to *C. triseta*.

Description. For a detailed description of this species, see Hall (1948) or Rognes (1991).

Specimens examined. 21 males, 32 females. **Panama:** 1 female, Panama Province, Panama City, Hato Pintado, Dec. 1994, D.J. Cavan (BYU). **South America. Argentina:** (9 males, 15 females): 2 females, El Bolson, Rio

Negro, Nov. 1–18, 1955, Andor Kovacs (LACM); 1 female, same data, except Oct. 10–15, 1956; 1 female, same data, except Jan. 10–13, 1957; 1 male, same data, except Oct. 1957; 5 females, same data, except Dec., 1957; 1 female, same data, except April, 1958; 1 female, same data, except Dec. 29, 1957; 1 male, Tucuman, San Miguel de Tucuman, IML Gardens, Dec. 18, 1979, L. Stange (FSCA); 1 male, Santa Catalina, near Buenos Aires, Nov. 10, 1970, Boyes (CNC); 1 male, Buenos Aires, Rio Lujan, Jan. 1977, S. Bolle (CNC); 1 female, same data, except Olivos, Nov. 1977; 1 male, same data, except Dec., 1977; 2 males, 1 female, same except Rio Lujan, Jan., 1977; 1 male, 1 female, Estancia Julia, Rio Chico, 69°30'W 49°40'S, Dec. 22, 1960, L Peña (CNC). **Chile:** (9 males, 13 females): 1 female, Lago Amarga, Puerto Natales, E. of Mt. Payne, Magallanes, 200m, Dec. 14–20, 1960, Peña (CNC); 1 male, 1 female, Chile Chico, Lago Buenos Aires, Aysen, Dec. 24–31, 1960, Peña (CNC); 1 female, same data, except Puerto Cristal, Jan. 9–10, 1961; 1 female, Coihaique, Rio Simpson, Aysen, March 7–9, 1961, Peña; 1 male Ensenada, Llanquihue, Jan. 13–15, 1962, Peña (CNC); 1 female, Bahia Municiones, Magellan Strait, Tierra del Fuego, Dec. 10, 1960, L. Peña (CNC); 3 males, 3 females, Cameron, S. Bahia Inutil, Tierra del Fuego, Magallanes, Nov. 23, 1960, Peña (CNC); 1 female, Puerto Cisnes, Aysen, 72°40'W 44°45'S, Feb. 1–15, 1961, Peña; 2 females, Concepcion, Concepcion, Nov. 22, 1970, J.W. Boyes (CNC); 1 male, same data, except Nov. 23, 1970. 2 males, Quillota Province, Parque Nac. Campanas, Palma de Ocoa, 32°93'24"S 71°07'81"W 215 m, Oct. 31, 1997, M. Irwin, E. Schlenger (USU); 1 female, Cautin, Villarica, March 5–15, 1995, G. Bohart, G. Aldrich (USU); 1 male, 1 female, Llanquihue, Mehuin, 39°26'20"S 73°12'90"W, 5m, pantrap, F.D. Parker (USU); 1 female, Llanquihue, Nilque, 40°42'9"S 72°24'40"W, Nov. 17, 2003, pantrap, F.D. Parker (USU). **Falkland Islands:** 1 male, 1 female, Port Stanley, Dec. 17, 1981, D. Hunt (UCDC). **Uruguay:** 3 males, 3 females, Soriano, Cardona, 33°52'60"S 57°22'60"W, May 20, 2008, T.L. Whitworth (TW).

Distribution. Widespread throughout the world, including the Neotropical Region. Central America: Panama. South America: Argentina, Chile, Falkland Islands, Uruguay. West Indies: Cuba (Peris and Gonzales-Mora, 1989). Hall (1948) commented that *C. vicina* is fairly common around Mexico City. This species likely occurs in the vicinity of many larger cities not listed here. The localities of examined specimens are shown in Figs. 1 and 2.

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APPENDIX. Notes on *Calliphora peruviana* Robineau-Desvoidy, *Lucilia peruviana* Robineau-Desvoidy, *Calliphora peruviana* Macquart and *Calliphora nigribasis* Macquart

by KNUT ROGNES & TERRY WHITWORTH

Introduction

The specific name *peruviana* has been created for three different nominal species in the Calliphoridae and assigned to two different nominal genera (*Calliphora* Robineau-Desvoidy and *Lucilia* Robineau-Desvoidy) by two different authors in two different years, i.e., by Robineau-Desvoidy in 1830 and Macquart in 1851. In addition the name *peruviana* has been misapplied by authors to the species *Calliphora nigribasis* Macquart, 1851. Below, the identity and status of the three problematical names, all based on material from Peru, are discussed and confusion regarding all are resolved.

Abbreviations of collections

OUMNH Oxford University Museum of Natural History, Oxford, UK
MNHN Muséum national d'Histoire naturelle, Paris, France

***Calliphora peruviana* Robineau-Desvoidy, 1830: 438**

Robineau-Desvoidy gave a short description, but the sex was not given. He stated that “[c]ette belle espèce, originale du Pérou, fait partie de la collection du comte Dejean [this beautiful specimen, collected in Peru, belongs in the collection of Count Dejean]”. Parts of Dejean’s collection were bought by Bigot, whose collection was obtained by Verrall and is now in OUMNH (Pont, pers. comm.). Macquart (1844: 288) observed that “[I]’individu que M. Robineau-Desvoidy a décrit sans distinction de sexe, et que nous avons vu, est une femelle...[the specimen which Mr. Robineau-Desvoidy described without indicating its sex, and which we have seen, is a female ...]”. Furthermore he illustrated the wing (Macquart 1844: Plate 16, fig. 9). Hall (1948: 301), citing the name as a senior synonym of and the valid name for *Calliphora nigribasis* Macquart, 1851, claimed that the type “male from Peru, ...” is “in the Bigot collection, Newmarket, England [= OUMNH]”. James (1970: 12) followed Hall and cited *peruviana* as the senior synonym of *Calliphora nigribasis* Macquart, 1851. However, it seems that neither Hall nor James had actually studied the OUMNH specimen or its labels.

According to Pont (pers.comm, and unpublished notes on the Bigot collection of Calliphoridae in Oxford, in KR’s possession) there are two specimens, one male and one female, under the drawer label reading “S. [= *Somyia*, where Bigot placed all the Robineau-Desvoidy and Macquart *Lucilia* and *Calliphora* names] Peruviana ♂ / Calliphora. id. R.D. / Peruvi. Rob. Desv.”. The male, not a type, is *Calliphora nigribasis* Macquart. The female, the type, carries a label in Robineau-Desvoidy’s own handwriting reading “*Calliphora peruviana* RD”. James Dear has labelled this specimen with (1) a holotype label reading: “HOLOTYPE / *Calliphora* / *peruviana* R-D / 1830: 438. / det. J.P. Dear 1977”; and (2) an identification label reading “= *Lucilia* / *peruviana* R-D / J.P. Dear 1977”. Dear thus considered the holotype to belong in the genus *Lucilia*, and not in *Calliphora*, as assumed by Robineau-Desvoidy himself. This interpretation of the specimen has not been published, neither the details of the drawer or specimens labels.

It is not known which Neotropical *Lucilia* species the name *peruviana* Robineau-Desvoidy (1830: 438) should be applied to. The type was not studied by Whitworth (2010). However, the problem of its identity is of academic interest only. Since there is another nominal species with an identical name, i.e., *Lucilia peruviana* Robineau-Desvoidy (1830: 455) (treated below), the former becomes a secondary homonym of the latter, and cannot be used. Although the identity of the latter is not known, it serves no purpose to resurrect this name by designation of a neotype to resolve its identity.

Mariluis & Peris (1985: 82) removed *Calliphora peruviana* Robineau-Desvoidy (1830: 438) from its position as a senior synonym of *Calliphora nigribasis* Macquart, 1851, on the basis of information given to them from Pont (citing Dear *in litt.*) to the effect that the holotype of *Calliphora peruviana* Robineau-Desvoidy, 1830: 438 is a *Lucilia* species.

In *Systema Dipterorum* (Pape & Thompson 2010) this nominal species is erroneously listed under the entry “*Aldrichina peruviana* Robineau-Desvoidy, 1830: 438”, and the type erroneously listed as being present in MNHN (Warning Work Record, Record # 38 329).

***Lucilia peruviana* Robineau-Desvoidy, 1830: 455**

Robineau-Desvoidy gave a short description, but again the sex was not given. He stated that “[c]ette belle espèce, originale du Pérou, fait partie de la collection du comte Dejean [this beautiful specimen, collected in Peru, belongs in the collection of Count Dejean]”. James (1970: 15) in the Neotropical catalogue, cited the name among unplaced species. The name has apparently since been unused. No material remains, as far as is known. Its identity is not known, and it serves no purpose to resurrect the name by designation of a neotype.

In *Systema Dipterorum* (Pape & Thompson 2010) this nominal species is correctly listed under “*Lucilia peruviana* Robineau-Desvoidy, 1830: 455”, but erroneously given the valid name “*Calliphora peruviana*”, and the type

is erroneously listed as being present in MNHN (Warning Work Record, Record #38 381). It is also given a separate entry in the database under “*Calliphora peruviana* (Robineau-Desvoidy, 1830: 455)” (same Record # 38 381), also the result of confusion.

***Calliphora peruviana* Macquart, 1851: 216**

This nominal species was obviously presented as a new species, and not just a record or citation of Robineau-Desvoidy’s species with the same name from 1830, since the entry reads: “*Calliphora peruviana* Nob.”. “Nob” is short for “nobis”, dative plural of “nos” (= “us”), and thus means “to us”, i.e., “our [thus Macquart’s] species”. Macquart gave a short description, including “... Thorax à ... reflets verts, ainsi qu'à l'abdomen ... Cuillers bruns... Ailes assez claires... [...] Thorax with green reflections, like the abdomen, ... calypters brown ... wings rather clear]”, stated that the specimen was a female and cited other data as follows: “Pérou. Payta. M. Eydoux. Muséum.”. The last word indicates that the specimen was housed in the Paris Museum.

In MNHN there is a female specimen with dark calypters which is labelled: (1) “*Calliphora / peruviana / ♀ Macq. n. sp.*” [in Macquart’s hand]; (2) “*Phryssopoda / splendens / Macq*” [in Seguy’s hand]; (3) “*HOLOTYPE / Calliphora peruviana Macquart / det. J.P.Dear 1977*” [Dear’s red handwriting, except last line which is printed in black]; (4) “*120/58*” [old handwritten ink label]; (5) “*Holotype*” [printed on red-rimmed white circular label].

One of us (TW) received from MNHN three digital color images of the holotype including an image of all its labels. To judge from the strong vitta of white pollinosity on each side of the presutural part of the thorax, widening out in front (where there is a very narrow dark line medially within the confines of the vitta) when seen from behind; the clear wing base; the bend of vein M forming a pronounced angle less than a right angle; dark calypters with a narrow white rim; and the concave T5 in profile view, it is a female *Neta chilensis* (Walker), although the hind femur is less swollen than usual. This identity of the type is in accordance with current understanding (Shannon 1926: 123, as *Neta splendens*; Hall 1948: 301; James 1970: 13 (entry listed as “*peruviana* Robineau-Desvoidy of Macquart, 1851: 216 ... (*Calliphora*)”); and Dear 1979: 150). Both Shannon and Dear had examined the type. The name *Calliphora peruviana* Macquart (1851: 216) is a junior primary homonym of *Calliphora peruviana* Robineau-Desvoidy (1830: 438) and thus permanently invalid. This fact was observed by Townsend (1892: 36) who proposed the replacement name *Calliphora paytensis* for the preoccupied name *Calliphora peruviana* Macquart. Thus Townsend’s name also falls into the synonymy of *Neta chilensis* (Walker) listed by Shannon (1926) and James (1970).

In *Systema Dipterorum* (Pape & Thompson 2010) the type of *Calliphora peruviana* Macquart (1851: 216) is listed correctly as being present in MNHN, and its valid name cited correctly as *Neta chilensis* (Warning Work Record, record #38 341). *Calliphora paytensis* Townsend, 1892 is not listed at all in *Systema Dipterorum*.

Nomenclatural summary

***Calliphora peruviana* Robineau-Desvoidy, 1830: 438.**

Holotype, female: OUMNH.

Identity: *Lucilia peruviana* (Robineau-Desvoidy, 1830: 438).

Status: Invalid name. Secondary homonym of *Lucilia peruviana* Robineau-Desvoidy, 1830: 455.

***Lucilia peruviana* Robineau-Desvoidy, 1830: 455.**

Holotype, sex unknown: Lost.

Identity: *Lucilia peruviana* Robineau-Desvoidy, 1830: 455.

Status: *Nomen dubium*.

***Calliphora peruviana* Macquart, 1851: 216.**

Holotype, female: MNHN.

Identity: *Neta chilensis* (Walker, 1837: 354).

Status: Objectively invalid name. Junior primary homonym of *Calliphora peruviana* Robineau-Desvoidy, 1830: 438. Replaced by *Calliphora paytensis* Townsend, 1892: 36.

***Calliphora nigribasis* Macquart, 1851: 215.**

Holotype, male: MNHN. Described from the male sex from an unstated number of specimens (here presumed to be only one) from “Amérique. Colombie.” in the possession of the “Muséum” [= MNHN]. According to unpublished notes by James Dear (now in KR’s possession) the labels read (1) “*Calliphora nigribasis* Macq. n.sp.”; (2) “34.42”; (3) “Museum Paris Colombie Parzudacki 1842”.

Identity: *Calliphora nigribasis* Macquart, 1851: 215.

Status: Valid name.

Synonymy:

Calliphora nigribasis: Mariluis & Peris, 1985: 82 (as “*Calliphora nigribasis* Macq., 1851”).

Calliphora peruviana: Hall, 1948: 301 (as “*Calliphora peruviana* Robineau-Desvoidy”). Misidentification, not *Calliphora peruviana* Macquart (1851: 215) and not *Calliphora peruviana* Robineau-Desvoidy (1830: 438).

Calliphora peruviana: James, 1970: 12 (as “*peruviana* Robineau-Desvoidy, 1830: 438”). Misidentification, not *Calliphora peruviana* Macquart (1851: 215) and not *Calliphora peruviana* Robineau-Desvoidy (1830: 438).

Calliphora peruviana: Baumgartner & Greenberg, 1985: 583 (as “*Calliphora peruviana* R.-D.”). Misidentification, not *Calliphora peruviana* Macquart (1851: 215) and not *Calliphora peruviana* Robineau-Desvoidy (1830: 438).

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